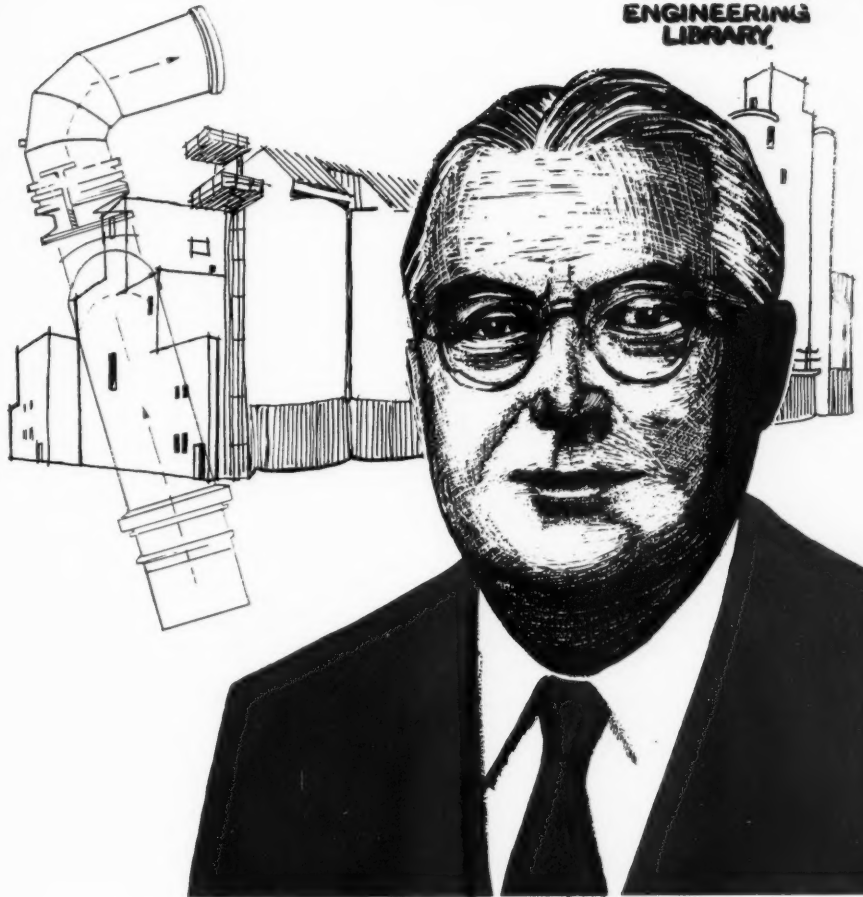


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Engineer's Engineer

WILLIAM H. BYRNE serves as able pinch-hitter and strong right arm for more than a dozen big engineering firms, constructors, and public utilities. Although the title is seldom applied to members of his profession, the role of "an engineer's engineer" is regularly and capably played by the big, genial engineer whose specialized services in engineering, design, and

(Continued on page 8)

Municipal Garbage Disposal

Auxiliary Circuit Protection

Research Laboratories

The Alcoa Building

Steeper Moving Stairways

Market Surveys

Aluminum Bonding

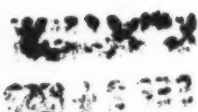
New Parking Projects

September 1953

CONSULTATION

DESIGN

CONSTRUCTION

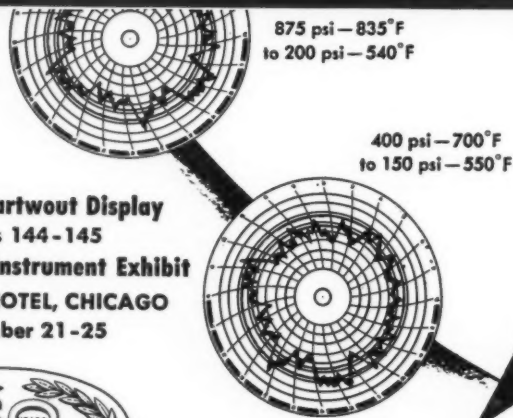
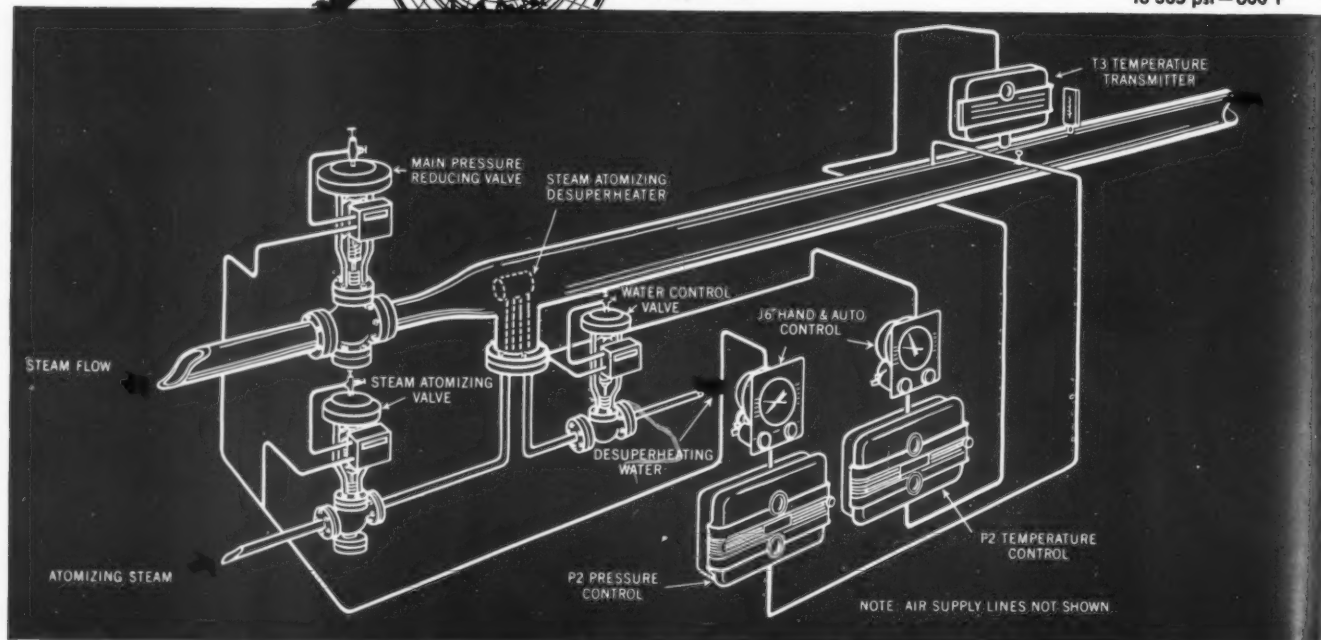
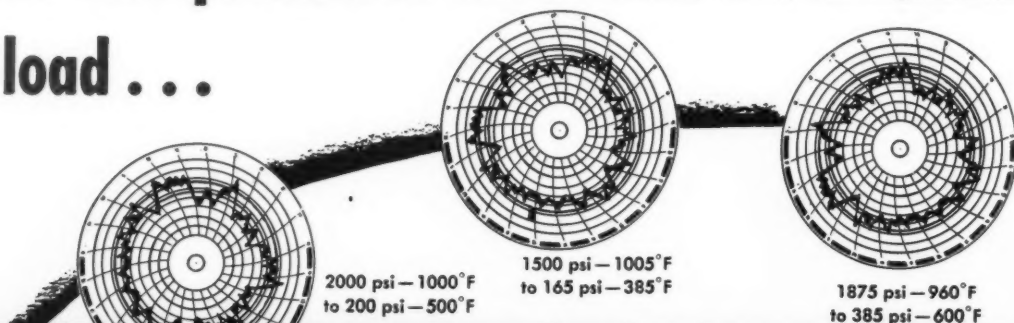


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NUMBER 7

consulting engineer®

SEPTEMBER 1953

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SEPTEMBER 1953

5

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Very truly yours,



THERE'S A WONDERFUL GLOW about our offices and we have you to thank for it.

Remember a few weeks ago we sent a letter-questionnaire to all readers of **CONSULTING ENGINEER** to obtain certain information needed for our circulation records. At the bottom of this letter, we left a little space for your comments—and we received enough comments to fill 57 typewritten pages! Wonderful comments they are, too, offering helpful advice, encouragement, complete approval, and, most important of all, they show that we're giving you the editorial fare you want. I think you'll enjoy reading a few of these sincere comments.

"You are to be commended for producing a unique magazine in that it is written by and for professional engineers with subjects of broad interest in a language that neither under- nor over-estimates the type of mind it is trying to reach"—T. M. Morong, Chief Engineer for the Salt River Power District in Phoenix.

"We find your magazine of value in that it gives us material not otherwise available"—P. H. Williams, Owner-Manager of Columbia Pump & Engineering Co., Santa Clara.

"We find this to be a very informative periodical. Furthermore, its presentation is such that it can be *read* without dry, technical study"—T. M. Deterling of Daniel, Mann, Johnson & Mendenhall in Los Angeles.

"This is by far the best engineering magazine I've seen. And I've been reading them for over 20 years"—R. G. Fitzgerald, Electrical Engr., Kaiser Aluminum Corporation.

Wish I had the space to print all your comments, but from these, I'm sure you can see how pleased we are. We're working constantly to make CE a better publication in every way, and such comments certainly go a long way toward making our job more enjoyable. My sincere thanks to all of you.

Very truly yours,

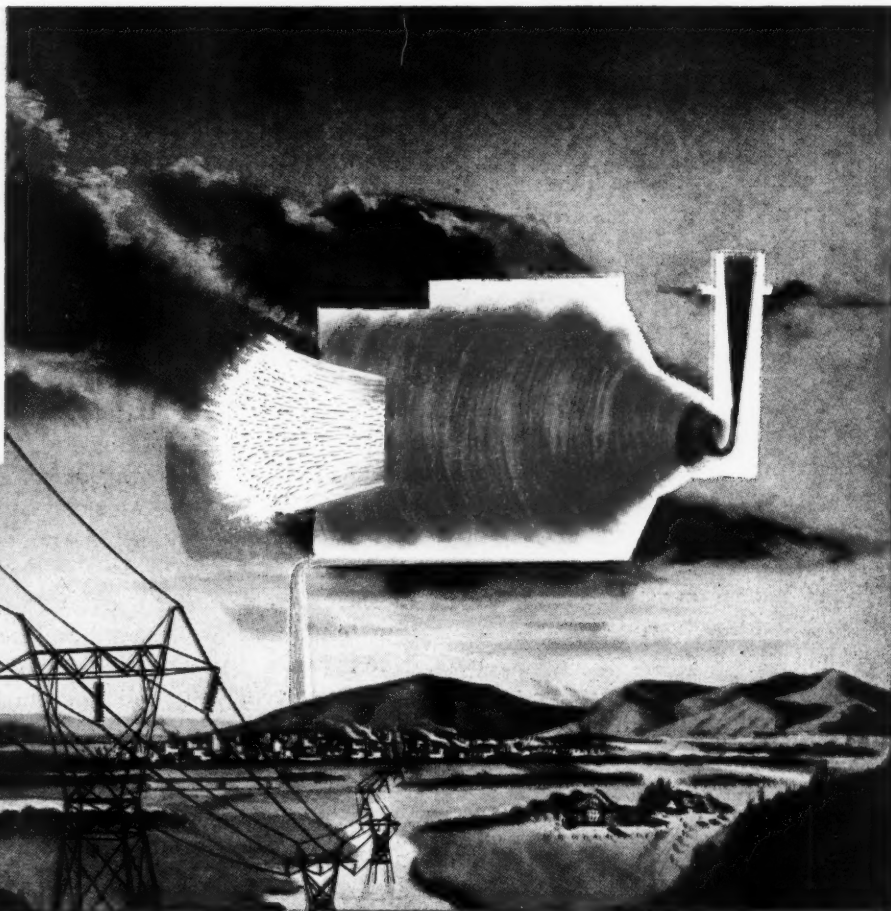
M. J. Sanders

Publisher

CONSULTING ENGINEER

Steam is literally the lifeblood of our American economy. Through it, the energy in our store of fuels is made available in useable form. Steam has always been taken for granted because it's cheap. But, with the depletion of top grade coals, with the increase in price of fuels generally, and with increasing construction and operating costs, major engineering concentration is required on the problem of . . .

**keeping
steam
cheap**



FOR THE WORLD'S MOST EFFICIENT ELECTRIC GENERATING UNIT *-The Cyclone Furnace*

All power plants make kilowatts; here's one that's making history!

The entire nation will benefit when American Gas & Electric Service Corporation ushers in a new era of power progress with the installation of its revolutionary new steam-electric generating system at the Philo Plant of the Ohio Power Co., near Zanesville, Ohio. For the first time, boiler engineers will break through steam's critical pressure barrier to achieve unprecedented 5500 pounds pressure and 1150 F steam temperature. The new boiler and turbo-generator unit will produce 120,000 kw—three times the power in the same space as the system it replaces—and will use 45 per cent less coal per kilowatt-hour.

To fire B&W's unprecedented boiler, the Cyclone Furnace—in itself an outstanding development in coal-burning technology—has been chosen to provide maximum

combustion efficiency and economy.

The Cyclone represents a vast simplification of the entire mechanism of preparing and burning coal—and, in one easy step, effectively solves the bothersome question of fly ash handling and emission from the stack. A high percentage of all bituminous coals in the United States can be burned efficiently in the Cyclone Furnace. It can handle a wide variety of coal from mines in all parts of the country. Regardless of where a coal-burning plant may be located, it will have an excellent competitive market in which to purchase coal suitable for firing in the Cyclone Furnace.

We will be pleased to discuss the Cyclone Furnace in terms of your specific public utility or industrial requirements and to submit data on the Cyclone's many advantages of particular benefit to you. The Babcock & Wilcox Company, 161 East 42nd St., New York 17, N. Y.

N-159

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BOILER
DIVISION

Engineer's Engineer

—Starts on Front Cover

appraisal work have brought him frequently into the news as a rate expert and public servant.

A consulting practice of the character operated by Byrne requires a large supporting team of designers, draftsmen, and specialists in many fields. To complement his professional undertakings, he organized Byrne Associates, Inc. which specializes in subcontract design and drafting. This engineering organization occupies several floors of a downtown Manhattan skyscraper.

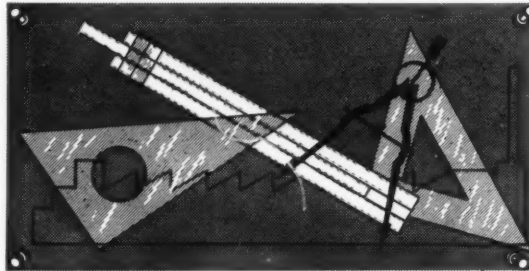
He also owns and operates the firm of Stevens and Wood, Incorporated, which operates in the same general field as Byrne Associates, Inc., but tends to specialize in power, marine, and management areas.

Bill Byrne stepped directly into electric utility operations on completing his training as a mechanical engineer at Stevens Institute and Brooklyn Polytechnic Institute in 1923. His early stamping grounds were the Hell Gate and Sherman Creek plants of United Electric Light & Power Co.—now part of Consolidated Edison Co. He started in the test and efficiency department and ended up as assistant to the chief engineer of the Sherman Creek plant. This affiliation started him in the field of combustion engineering.

Then followed a period, appropriate to the making of a professional engineer, during which Byrne continued to gain experience in power plant design, operation, and construction with such firms as Furnace Engineering Co. of New York; with Stevens and Wood, engineers and constructors; as superintendent of production with the Cuban affiliate of American & Foreign Power Co. in Havana; as sales engineer with Condenser Service and Engineering Co.; and as sales engineer of combustion control with the Hagan Corp.

In 1936, he joined the New York Public Service Commission as principal valuation engineer, a post he held until 1944. Here Byrne served on several big rate cases, developing a reputation as a skilled technician and widening his contacts among utility men throughout the state.

After a short period as a partner in a consulting engineering firm, Byrne organized his own business in 1944. In conjunction with his consulting firm, he formed his present principal firm, Byrne Associates,



Inc., with the idea of developing the second organization into a versatile but flexible group, capable in all facets of engineering and subcontract design and drafting. He was soon handling a growing amount of work under the engineering direction of such firms as Ebasco Services, Inc., Consolidated Edison Co., Jackson Co., Jackson & Moreland, Westcott & Mapes, N. A. Lougee & Co., and Chemical Construction Corporation.

Byrne built up a compact group of other consulting services. In 1946 he acquired Stevens and Wood, Incorporated, a well-known firm in the utility and industrial power field. He fashioned it as a vehicle for handling engineering service contracts for government agencies, and is now grooming the firm for large-scale contracting in specialty fields. One of these is the mapping of sewage, telephone, gas line, and electric systems for public utilities.

On many occasions Byrne has joined in partnership with architectural firms and others to carry out the design and supervision of project construction including specialty housing, schools, hospitals, industrial buildings, and aircraft motor test cells.

Byrne finds time for varied personal projects in the field of design, appraisal, and engineering reports. Not the least of his personal undertakings was his work in 1949 for the New York City Department of Housing and Buildings in establishing and serving as director of city's first Bureau of Smoke Control.

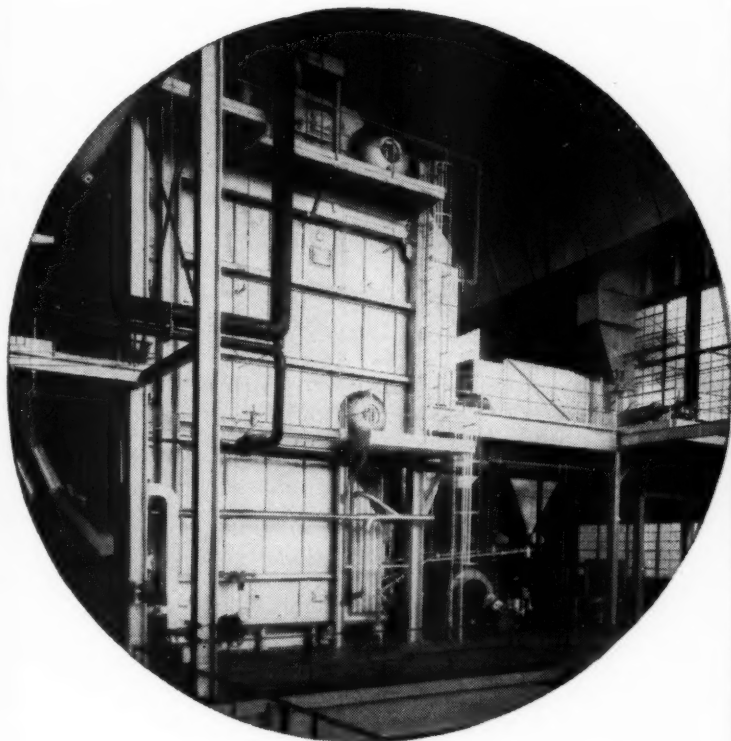
Today, business is flourishing as never before for the Byrne group. Painstaking attention to detail and close adherence to policies and standards of customers have paid off. The subcontracting business still accounts for 80 percent of overall volume. Byrne makes clear that while he intends to stay in this business, he has hopes of building up the other branches of his organization.

He has other professional interests. Byrne has invented a successful powdered fuel burner and a method for closely controlling temperature in combustion chambers. He is a director of several corporations; one of them, Plant Economy, Inc., has successfully introduced a new type of insulation utilizing layers of reflective aluminum for use in processing industries and public utilities.

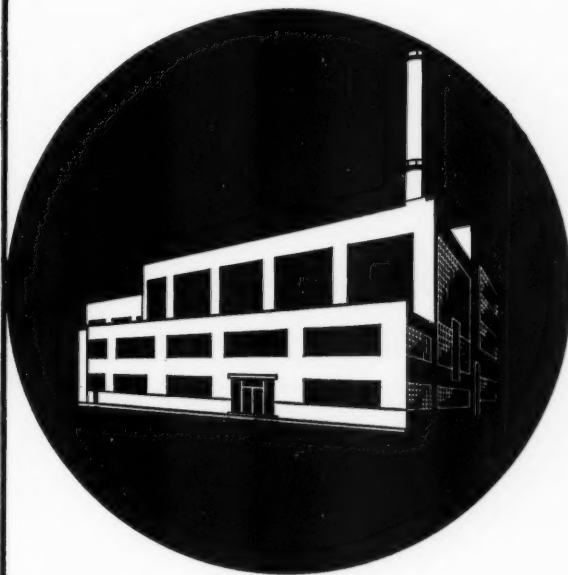
Wrestling with problems of fuel usage and control in power plants, with smoke abatement and legislative work on local committees, or attending meetings of the ASME, the New York State Society of Professional Engineers, and the American Society of Appraisers—these fill "after-hours" moments in the productive life of this engineer's engineer.

City of Manitowoc installs fifth WICKES steam generator

To provide a dependable source of power for the City of Manitowoc, Wisconsin, the Manitowoc Public Utilities Commission has just installed a fifth WICKES Steam Generator capable of producing 175,000 lbs. of steam per hour at 525 psi. Final steam temperature is 750°F. The new WICKES Boiler has 11,600 sq. ft. of heating surface. It is equipped with an economizer and fired by spreader stoker.



R. E. Cannard — Chief Engineer and General Manager



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READERS' COMMENT

Free Piston Engines

Dear Sir:

Permit me to congratulate you upon the current August issue of *CONSULTING ENGINEER*.

I want to especially compliment you on the article "Free Piston Engines," since in my opinion it is the most lucid description of free piston engines, a much misunderstood prime mover.

Will be looking forward to the next issue of *CONSULTING ENGINEER* with keen anticipation.

H. A. Wagner, Director
American Association of Engineers
Chicago, Illinois

Still Ethical Discipline

Dear Sir:

The writer has just read the article in your June issue entitled "Engineers Need Ethical Discipline," by Frederick H. McDonald.

Having experienced the same situation as explained in this article, I can sympathize with the feelings of the writer.

I would like to have some reprints of this article if they are available. These will be used for distribution to Engineers in private practice of my acquaintance who may not have had the opportunity to read this article.

W. P. Wells
Professional Engineers of
North Carolina
Charlotte, North Carolina

● REPRINTS ARE NOW AVAILABLE, SEE PAGE 79.—Ed.

Dear Sir:

Thank you for the six copies of the June, 1953 issue of *CONSULTING ENGINEER* which I requested.

Expect to distribute these copies to fellow members in Chicago this next week-end and will request them to write you direct.

This article came to my attention in the office of Mr. Wayne Palmer, President of Palmer and Baker, Consulting Engineers of Mobile. He

was much impressed with the article and stated that it covered almost an identical situation which he encountered with the government.

J. A. Higgs, Dist. 10
Director, ASCE
Atlanta, Georgia

Small Firm Publicity

Dear Sir:

Would appreciate the address of V. W. Palen whose article "Your Firm Can Afford Publicity," appeared in your June, 1953 issue.

Alden Elstrom
Alden Elstrom Associates
Minneapolis, Minnesota

Dear Sir:

The June issue of your excellent publication contains an article on which I would like very much to obtain additional information. I refer to the article by V. W. Palen on "Your Firm Can Afford Publicity."

Would you be so kind as to advise me of Mr. Palen's address or request that he communicate with me. Your assistance would be greatly appreciated.

S. A. Birn, President
Serge A. Birn Co., Inc.
Louisville, Kentucky

● PALEN'S ADDRESS IS: 158 HOLLYWOOD AVENUE, CRESTWOOD, TUCKAHOE 7, NEW YORK.

Atomic Power Survey

Dear Sir:

In general, it is our opinion that you summarized very well the materials for your piece on "Industry and Atomic Power." It was unfortunate, however, that so much time had to elapse between the time that we submitted the report to the Commission and the date that it was made public. This means that the power levels, coolant temperatures, and mechanical design features of that original report are now quite outdated on the basis of our studies since then. Some of the revised numbers could be made available to

you, however, if it would serve any purpose at this time.

Philip N. Powers
Executive Administrator
Atomic Electric Project
Monsanto Chemical Company
St. Louis, Missouri

● MOST RECENT DATA WILL BE PUBLISHED IN OCTOBER ISSUE.—Ed.

Dear Sir:

Your July, 1953 issue contained a very interesting article on Atomic Power Plants which I am most anxious to obtain.

I would appreciate your sending me a reprint of the article or a copy of the magazine and bill me for any charge involved.

R. E. Hartman
Manning, Maxwell & Moore, Inc.
Stratford, Connecticut

Subcontracting Drafting

Dear Sir:

The article in the July, 1953 issue of *CONSULTING ENGINEER*, "Subcontract Your Drafting" is of special interest to this organization.

We would like four copies of this particular issue, for the use of our Sales organization. We do considerable engineering and drafting for such companies as du Pont, Burroughs Adding Machine Company, Philco, Bethlehem Steel, etc., and feel that the article is timely and well written.

A. G. Werther
General Design, Inc.
Philadelphia 2, Penna.

Cooling Towers

Dear Sir:

Please send to the writer's attention a copy of your very fine *CONSULTING ENGINEER* for July, 1953.

We are particularly interested in the article by H. Raymond Baker, Jr., of the Degree Corporation, Houston, Texas on cooling tower specifications.

Chas. J. Kelly
Diehl Pump & Supply Co., Inc.
Louisville, Kentucky

Plastic Drafting Stamps

Dear Sir:

On page 56 of July, 1953 issue of *CONSULTING ENGINEER*, there is an article on "Transparent Drafting Stamp Made of Acrylic Plastic."

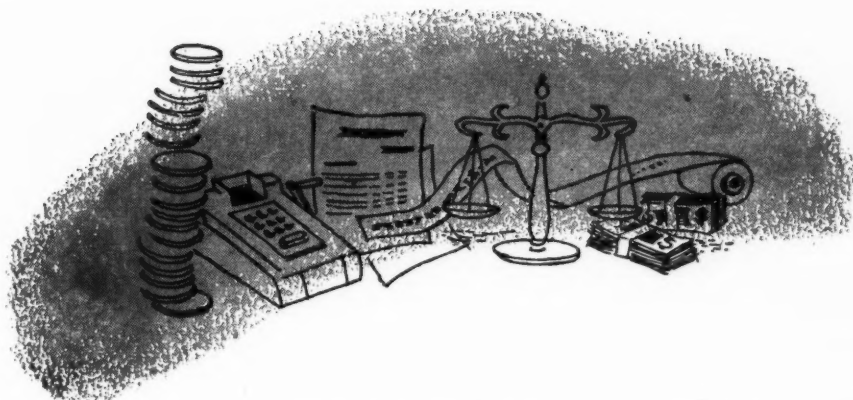
If you are in a position to furnish us any further information concerning this drafting stamp, we will very much appreciate it.

Miss M. Nettle, Librarian
Guy F. Atkinson Company
South San Francisco, Calif.

● MANUFACTURER, JOHN GRIFFEN CO., 2157 JAMES AVE., ST. PAUL 5, MINN.

ECONOMIC NEWS NOTES

E. F. Mac Donald
INDUSTRIAL ECONOMIST



◇ **INDUSTRIAL RESEARCH** — More than \$3½ billion was spent for scientific research and development in 1952. Two-thirds was for work done in facilities owned or operated by private industry, almost one-fourth was for research by the government in its own labs, and the remainder was for work done by colleges. About 94,000 research engineers and scientists were employed by 1,934 companies, accounting for nearly all industrial research and development. Over half the total was employed in three industry groups: electrical machinery, aircraft, and chemicals. Average research cost per engineer or scientist was \$22,000 in 1951. Cost of research averaged about 2 percent of total value of sales of companies employing research personnel. See "Industrial Research and Development," issued by Bureau of Labor Statistics and the Research and Development Board of the Dept. of Defense.

◇ **ECONOMIC REPORTERS** — A nationwide network of economic spotters is being set up by Walter Williams, Under Secretary of Commerce. It will consist of businessmen who will scan the screen of business activity in their areas and report the "blips" they observe in the form of economic weaknesses. It is hoped that their reports, together with surveys and information from government and other reporting agencies, will give the Administration a running start on nipping an economic slump in the bud.

◇ **FIRE** — There must be some new lessons and designs to be worked out as a consequence of the fire that gutted GM's Livonia plant. It was small consolation to GM that the plant had been constructed in accordance with fire, insurance, and building codes and regulations and was as well protected as "90 percent of industrial plants." Incidentally, a recent survey of warehouse facilities by the National Board of Fire Underwriters is timely in pointing out that considerable construction work is needed to revamp existing structures to eliminate fire hazards and protection inadequacies.

◇ **STANDBY PLAN** — Army Ordnance's plan for taking defense-production equipment off the line will enable the reconverted plant to (1) lease equipment for civilian production at a monthly rental of 1 percent of original cost, or (2) store it in place in the plant or in company warehouses, receiving a rental from the Government. Equipment not so handled will be packed away in nearby warehouses or shipped to the closest government depot. Criticism of the plan points out that 25 percent of all machine tools in the country are owned by the Government and that rental of the equipment could have a serious impact on the market for new machine tools in the future.

◇ **NEW POWER POLICY** — The policy statement by the Secretary of the Interior, endorsed by the Administration, holds that the Department "does not assume that it has exclusive right or responsibility for the construction of dams or the generation, transmission, and sale of electric energy in any area, basin, or region." Although this doesn't take Washington out of the power business, it is a decided departure from New and Fair Deal planning. It means that Interior will not oppose projects which "local interests, either public or private, are willing and able to provide." Federal construction of hydro-electric facilities will be restricted to projects in which power is mainly a by-product of irrigation or flood control.

◇ **FOR SALE** — The Army Corps of Engineers advertised for sale or lease a \$30 million anhydrous ammonia plant and two synthetic liquid fuel plants in Missouri. The RFC plans to dispose of its 20-year collection of securities, business loans, and residential mortgages. Unsold items at June 30, 1954 will be turned over to the Treasury. The Secretary of the Army has ordered a complete review of all property holdings of the Army with the idea of disposing of acreage not needed by the Service.

◇ **IN PASSING** — Housing improvements financed by FHA insured loans for home repair and modernization have reached record levels. FHA is receiving nearly 40,000 applications a week . . . The **Pentagon** is planning to publish a complete guide to all equipment and supplies purchased by the armed services. To date, 28 segments of the catalog, which will take two years to complete, containing almost 53,000 items, have been published and are available at U.S. Superintendent of Documents . . . At the recent Governors' Conference in Seattle, **Byrnes of South Carolina** held that "The conditions that justified Federal aid and control of highway construction no longer exist." If a redivision of tax sources can be effected between the Federal government and the states, he suggested that states refuse new Federal aid projects . . . **AT&T stockholders** will vote October 14 on a proposed new issue of \$625 million of convertible debentures. If approved, this will be the largest single private financing in history . . . Growth industries should include **glass fibers** which has been getting a boost from a wide variety of applications, the latest being wallboard products for the building trade; **handling equipment**, which has a huge potential market that should be susceptible to proper promotional efforts; and, of course, **TV** — which might be on the eve of another boom . . . The Internal Revenue Service says that its eye is sharper than ever in looking at "**business expense**" deductions. It has warned that it looks closely for personal pleasures included in business expenses.

ATOMS IN ACTION

NEW RESEARCH CONTRACTS--The U. S. Atomic Energy Commission has awarded 47 physical research projects in the field of atomic energy to universities and private research groups. These contracts, mostly for a term of one year, were let as a part of AEC's stated policy of using private laboratories where possible. Only one of the contracts, for "Process Development for Production of Thorium Metal," (to Horizons, Inc.) was let to a private research group not connected with an educational institution. The projects are being jointly financed for the most part, the institution contributing funds and services which it normally devotes to work in that field, and the AEC providing assistance to make possible the purchase of equipment and payment of additional salaries.

NO REAL RACE--J. E. Tobey, president of Appalachian Coals, Inc., has collected a hopper-full of quotes to reassure the coal industry. According to Tobey there is no need to close up mines because of competition from atomic power plants. In fact, projects now under construction by AEC will use about 23 million tons of coal each year. Present consumption of AEC plants is less than 3 million tons. The expert witnesses at recent Congressional hearings do not look for power from fissionable fuel on a competitive basis in "the foreseeable future," Tobey says. He quotes Sir Henry Tizard, the British scientist, "I cannot yet see the slightest evidence that atomic energy can replace coal as the basis of material civilization, nor that the use of atomic energy for the production of power can significantly raise the standard of living of any nation, within the lifetime of any living person." but Tizard's statement dates back to 1951.

PRACTICALLY NO COMMENT--Despite all of the talk about Russia having the Hydrogen Bomb, the only statement to come from Lewis Stauss, Chairman of the Atomic Energy Commission, is, "The Soviet Union conducted an atomic test on the morning of August 12. Certain information to this effect came into our hands that night. Subsequent information on the subject indicates that this test involved both fission and thermonuclear reactions.

"It will be recalled that more than three years ago the United States decided to accelerate work on all forms of atomic weapons. Both the 1951 and the 1952 Eniwetok test series included tests involving similar reactions."

REMEMBER WHEN?--We should not complain about lack of information. Remember when we all thought the big plant at Oak Ridge was being constructed to manufacture fifth-term campaign buttons?

BENEFICIARY MISSING--The U. S. Treasury finds itself in the peculiar position of holding a check for about \$18,750 made out to an atomic scientist who is very unlikely to call for it in person, if at all. Bruno Pontecorvo was one of the seven scientists granted a patent by the U. S. in 1940 for a "Process for the Production of Radioactive Substance." The Commission and its Patent Compensation Board recently settled with this group for \$300,000 as compensation for patent infringement. But Pontecorvo is not around to collect. He disappeared in 1950 in flying from England to Finland, and he is now believed to be in the Soviet Union. If he does manage to collect, we will be in the position of paying a Soviet scientist (assuming that he is now working for them) for work in the field of nuclear physics.



DR. KINSEY has had very little to do with a sudden awareness of the facts of life by many of our engineering acquaintances. Salaried engineers (and practically all are salaried, even those with consulting firms) have waked up to the fact that they are not making enough money. It is true that few engineers are starving, but the average engineer, who is actually doing engineering work, makes about \$7000 - \$8000 when he has been out of school 10 years. Any medical doctor, dentist, or lawyer who is not doing better than that is either dedicating his services to humanity or has lost his books, text or tax.

To further confuse the issue, the young graduate engineer starts his career with a higher income than his friends from medical or law school—which so far as we can tell only gives the doctors and lawyers a chance to cry into their ten year old Scotch about what a hard time they had as interns and clerks.

Before anyone gets us wrong, we would explain that we are not starting a campaign to cut incomes of doctors and lawyers. Quite the contrary. We want engineers to join them.

We brought up this problem when talking with an eminent economist, and he put a quick stop to our silly questioning with, "Heavens, boy, haven't you

ever heard of supply and demand?" We had. But somehow this does not fit with the current raging drive to recruit more and more engineering students because of the "shortage of engineers." If we remember correctly, when the demand is greater than the supply, the price is supposed to go up. In the employment of engineers, this rule seems to apply only to young graduates, not to experienced men. Experienced engineers can make a better living in sales or management work.

Or if we follow through on this rather asinine logic, we find that there must be a dearth of inexperience and a drug of experience among engineers. Silly as this may sound, there is some basic truth in it. Few men in top management feel capable of figuring the stress and strain on a beam—a job any second year man could handle, but they feel fully qualified to select plant locations, or the spot on a river where a bridge should be built (politicians are particularly qualified in this field), or to decide how much of the money allotted to a building project should go into the power plant or the air conditioning system. Every layman who ever owned a No. 7½ Erector Set feels fully capable of making major decisions; but he runs to the doctor when frightened by a Serutan ad.

We can see no solution so long as the engineer is primarily a salaried employee. If doctors or lawyers were salaried, they would face the same problem. Look at the poor teacher and preacher. They are both professional men, but they, like the engineer, work for salaries—and peanuts. There lies the answer, in fees as opposed to wages.

The change would not be easy, but perhaps it is possible. If even a third of the graduate engineers in this country were to be employed on a fee basis, the effect on the income level of the profession as a whole would be startling.

Give Gladly



THE UNITED WAY

UNITED COMMUNITY CAMPAIGNS

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The Davidson Company

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THIS MAGAZINE IS OUR RECOMMENDATION



DUMPING IS THE OLDEST AND EASIEST WAY TO GET RID OF GARBAGE — BUT IT IS A BLIGHT ON THE COMMUNITY.

Municipal Garbage Disposal

New Approaches to an Old Problem

A STAFF REPORT

THE SERIOUS AND CONTINUING number of visceral leishmaniasis and trichinosis cases transmitted to human beings from garbage fed hogs, has caused enactment of state legislation forbidding the use of uncooked raw garbage as animal feed. Twenty-eight states have already passed—or are considering immediate passage of—laws effective within 60 to 90 days to prohibit this practice.

Roughly 40 percent of all municipalities rely on contracts with animal feed distributors or dealers to dispose of their raw edible garbage. Now that this method of disposal is being outlawed, many municipalities are facing a serious and imperative garbage disposal problem. Devising a satisfactory and economical method of garbage disposal is of direct concern to the engineering consultant.

The oldest and easiest way of getting rid of garbage is to dump it on an undesirable vacant land

Growing municipalities, a new technology, state laws and city ordinances, economy measures, all call for a new and modern engineering approach towards the problem of municipal garbage disposal methods.

site. It seemingly involves a minimum of expenditures, little engineering, and less effort. But it creates a number of other problems.

The animal and vegetable wastes and other organic solids putrefy. This slow oxidation process creates foul odors, serves as a breeding place for germs, flies, and mosquitoes, and can pollute nearby streams and well-water supplies. Even if partially or wholly covered with earth, the land remains

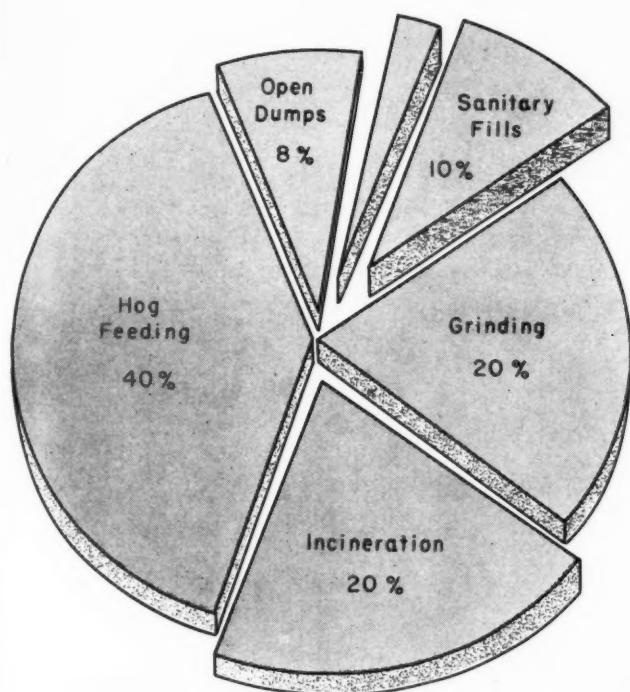
virtually worthless for many years. A look at most city dumps or land fills is convincing evidence of the depressing effects, social and economic, that this blighted area has upon the neighborhood.

Grinding

Grinding garbage, especially in small home kitchen units, is increasing in popularity. Ground garbage is passed through the sewage collection system and reduced and digested with other waste solids in the sewage treatment plant.

The disadvantages of grinding garbage, either on a home or community basis, are the high initial capital investment costs, the added burden to the sewers and disposal plant, and the fact that none of the valuable ingredients in the garbage are recovered.

Garbage is composed of moisture, ash and organic



A PIE CHART GIVES A BREAKDOWN OF THE TYPES OF GARBAGE DISPOSAL METHODS PRESENTLY USED.

matter. If properly dried and burned, it can be almost completely consumed. The small quantity of ash is easily handled, and the metal wastes can be sold for scrap to local dealers.

To put the incineration method on a paying basis, a new incinerator with a waste heat boiler to generate steam that could be profitably sold to the local power company was installed in Atlanta, Georgia in 1941 and began operating in 1942.

Collected garbage is dumped in a pit, carried by overhead crane to hoppers, then by conveyor to a drying grate. After the moisture has been driven off, the dried fuel is fired in a burning chamber. A

rotary screen sifts the ashes and sorts out salvage metal, mostly tin cans, for resale as scrap.

The accompanying table shows the operating costs and the savings effected over 11 years by the sale of steam and tin cans for salvage.

Animal Feeding

Swine and other domesticated animals can sustain a healthy diet by eating raw edible garbage. As a matter of fact, many farmers who raise swine will arrange to get garbage from restaurants or other collecting agencies to feed as swill to their animals. Some one million head of swine in this country are fed raw garbage as all or part of their regular diet.

In some respects, this practice is not sanitary and can pose a serious health menace. Worms, bacteria, and disease germs breed in foul garbage. The potential danger is that animals bred for human consumption may transmit these infections to human beings if fed on raw garbage.

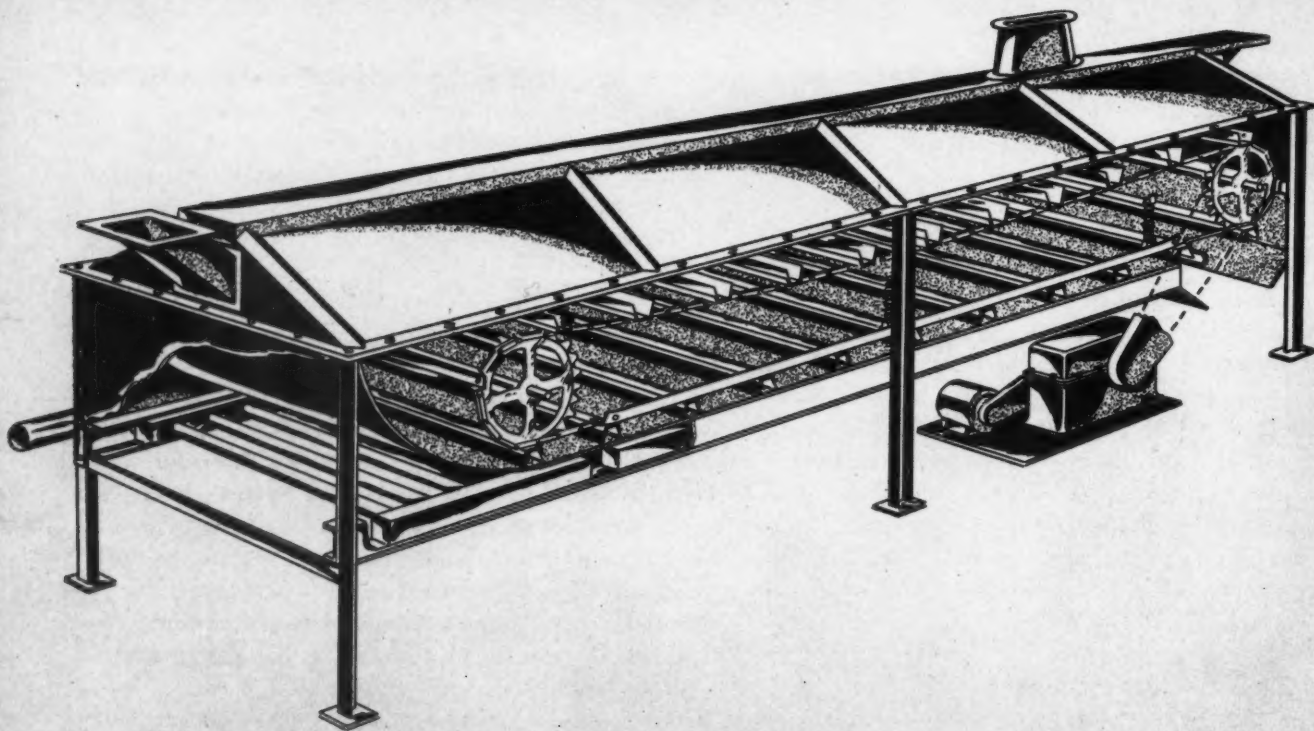
Both England and Canada have laws requiring the heat-treatment of garbage preliminary to feeding to animals. In this manner they have considerably lowered mortality and morbidity rates among garbage fed hogs. Also the incidence of human trichinosis in England and Canada is stated to be about one-twelfth that in this country.

Obviously, only edible garbage can be used for animal feed. If the householder is to be relied upon to sort and pack his garbage in two containers, he must be educated in this program. Provisions must be made for separate collections and great care exercised to make sure that no foreign objects as glass or metal caps appear in the feed product. Many municipalities, especially those using the method of hog feeding, are already successfully practicing and enforcing separate edible and non-edible garbage



International Incinerators

THE CITY OF ATLANTA RECEIVED OVER \$155,000 LAST YEAR FROM SALE OF THIS TIN CAN SCRAP.



GARBAGE DROPS DOWN (TOP LEFT) ON THE CONTINUOUS COOKING CONVEYOR AND PASSES ALONG THE STEAM HEATED FLOOR WHERE IT IS COOKED FOR ABOUT 30 MINUTES AT 212 F. BEFORE BEING DISCHARGED (BOTTOM RIGHT).

packaging and collecting although at a higher cost.

Composting is a method of treating garbage with bacteria—the exact reactions are not fully understood as yet. Evidence indicates that wet garbage can be composted to a dry organic fertilizer, free of any disease producing micro-organisms, in about 48 hours for a cost of about \$6.00 per ton (dry). This end product has an estimated sale value of \$15.00 to \$20.00 per ton (dry) to the farmer.

The composting process has been used for treating garbage, notably in Oakland, California and at Bay Shore, Long Island. For one reason or another, but primarily because of inadequate operating knowledge, these commercial ventures have not been successful and are temporarily abandoned.

Dr. John R. Snell, Head of the Department of Civil Engineering at Michigan State College, is responsible for extensive research projects on composting. He believes that it may be a number of years, depending on the intensity of research made possible by the available financial support, before sufficient knowledge of the reactions, controls and operating data become known to justify the full commercial application of the composting method.

Experiences in Omaha

The city of Omaha, Nebraska used to feed its raw garbage to hogs until an outbreak of visicular exanthema (a virus similar to foot and mouth disease) caused the Nebraska State Legislature to pass a law

prohibiting this practice. To meet this emergency, a drying process was installed in September, 1952 and the entire garbage output cooked.

Until markets could be established, the Mayor and City Council voted to subsidize the process at the rate of \$2500 per month or \$30,000 per year. As alternatives, it would cost the same to grind and dump the garbage into the Missouri river—contributing to that river's further pollution; or, the sanitary land-fill method could be used at a cost several times as much as the present subsidy payment.

Mr. Herbert H. Ulrich of the Sanitation Commission of Omaha, who was responsible during this garbage crisis, had this to say in a letter to the Public Works Department of Ann Arbor, Michigan: "The justification of the present system of garbage disposal in Omaha would include the following items of merit:

1. The process is a contribution to local industry and agricultural feeding operations.
2. Useful feed, approaching one-quarter million dollars, or more in value, can be produced annually from material ordinarily considered worthless.
3. The dried feed is sterile and acceptable to the market, and the method does not contribute to the pollution of waters.
4. Even if a sanitary land-fill were to be used for trash, the presence of garbage is not an asset to the land-fill operation."

Mr. Ulrich goes on to explain that the process

of many people to wrap the garbage in papers, are now under consideration.

Comparisons

A survey of the refuse disposal problem over a period of twenty years (1950-1970) was made for ten municipalities in southeast Michigan by Mark B. Owen, consulting engineer from Indianapolis. With an estimated population in 1970 of 250,000, using the sanitary land-fill method would require 340 acres of land and the cost would average 41 cents per person per year for twenty years.

For the same period, a modern incinerator would require a capital investment of about 1½ million dollars, would handle 500 tons of garbage per day, occupy ten acres of land, and have a per capita operating cost of 50 to 55 cents.

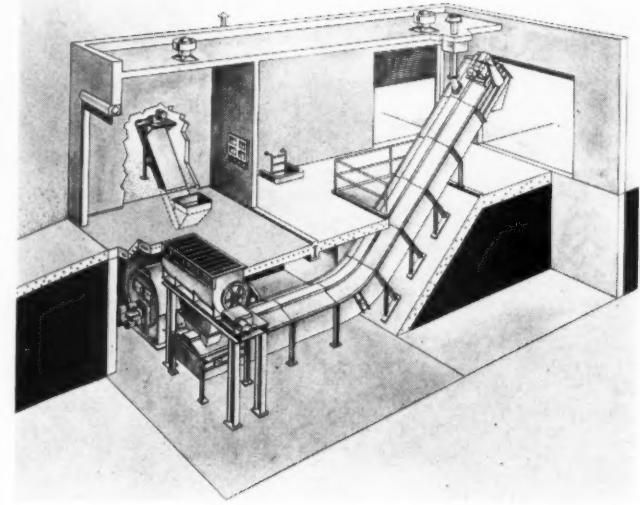
The Atlanta combination incinerator and waste heat boiler, previously mentioned, showed a gross cost per ton of refuse burned in 1952 of \$1.68 and a net profit per ton of \$.28. The 350 ton per day addition to the incineration capacity cost approximately 1¼ million dollars. If it continues to show a \$50,000 profit each year it will pay for itself within 25 years.

Because the above figures are not calculated from like data and do not take into account regional differences in dietary habits, wages and prices, and other variables, they serve only as a rough indicator of some of the economic aspects of the different methods of garbage disposal.

Trends

Cooking garbage, though certainly not a new development, seems to be the latest trend in municipal garbage disposal. The Hapman-Dutton Co. of Kalamazoo, Michigan, is working in the field of developing and marketing equipment for this cooking process. They believe that eventually all edible garbage should be cooked in a manner compatible with the

(Continued on page 62)



THE HAPMAN-DUTTON INSTALLATION WILL CONTINUOUSLY COOK 4 TONS OF RAW GARBAGE PER HOUR.

should eventually be self-sustaining and profitable, especially if there were a greater tonnage of garbage than is available in Omaha, (population roughly 250,000). He did not infer, however, that the process will ever pay for the cost of garbage collection.

During the winter of 1952, the dried garbage production ran about ten tons per day. It was estimated that over a year's time, production approximated 4000 tons or more. The present price for this dried garbage solids is about \$40.00 per ton. The market so far has absorbed the local production.

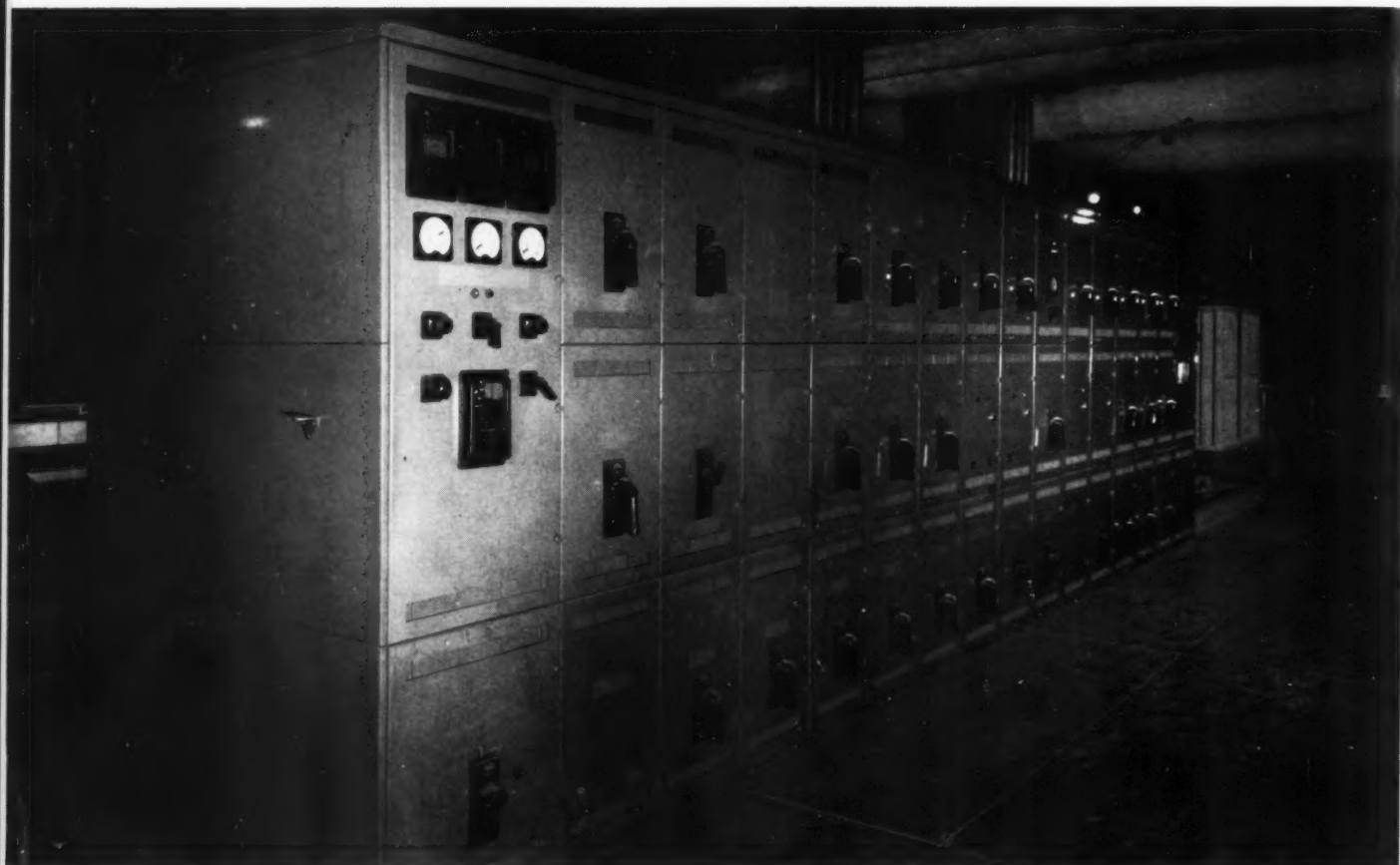
The method of processing the garbage consists of first grinding the raw garbage and then drying it in what is commonly referred to as a "rotary drum flash dryer." The material reaches a temperature of 260 F and is sterile when it leaves the process.

The problems presently facing Omaha include the undertaking of a city-wide trash and garbage pick-up. The questions of whether combined or separate pickup will be used, its cost, and the desire

UNIT COST DATA
ATLANTA'S INCINERATOR — WASTE HEAT BOILER
11 YEAR PERIOD — 1942 THRU 1952

Year	Tonnage refuse burned	Revenue tin cans	Revenue steam	Revenue total*	Gross operating cost	Net operating cost	Cost per ton	
							Gross	Net
1942	88,379	\$ 2,996	\$ 48,655	\$ 51,651	\$ 82,705	\$ 31,054	\$0.94	\$0.35
1946	106,472	13,976	61,839	75,815	111,462	35,647	1.05	0.34
1948	110,211	81,128	89,639	170,818	145,967	30,851**	1.32	0.28**
1950	111,785	83,723	87,097	172,952	156,388	16,563**	1.40	0.15**
1951	109,038	116,601	90,529	211,573	173,614	37,959**	1.59	0.35**
1952	129,737	155,256	114,052	274,359	219,034	55,364**	1.68	0.28**

*Includes additional revenue received for scrap iron and crates.
**Profit.



UNIT BOARD NO. 1 DISTRIBUTING 480-VOLTS AT SHAWNEE STEAM STATION OF THE TENNESSEE VALLEY AUTHORITY.

Protecting Auxiliary Circuits

at T.V.A.'s Shawnee Steam Station

SVEN KVAVEN

Chief, Electrical Design Branch
Tennessee Valley Authority

DOUGLAS M. DAYTON

Application Engineer
I-T-E Circuit Breaker Company

THE TENNESSEE VALLEY AUTHORITY has in the past been able to handle most of its expanding residential, commercial, and industrial load. However, the abnormal postwar increase in this load coupled with recent rapid industrial development have imposed much more than a normal growth rate. Originally, TVA was predominately hydro-electric with only small steam reserves. The system is

now rapidly increasing its steam power capacity.

The Shawnee station, adjacent to Paducah, Kentucky, is one of the new steam stations. As in any steam power generation installation, the auxiliary station equipment plays a very vital role. This equipment—pumps, fans, conveyors, crushers, and other machines—are all motor-driven from 4160-volt and 480-volt sources.

In the selection of protective equipment for auxiliary equipment power systems, the prime consideration is service continuity. This is achieved at Shawnee by a system design employing two major features: the first is an automatic throwover scheme whereby a second source will be automatically connected to the load upon loss of the normal source; the second feature is a series of selective trip coordinations which confine all fault interruptions to the faulted part of the circuit.

A portion of the 480-volt system is shown in Fig. 1. The diagram shows the auxiliary power supply to the common 480-volt auxiliaries of the station, and

to the unit 480-volt auxiliaries of a typical generator.

Common Auxiliaries

The system for the common auxiliaries begins at the common 4160-volt bus. This bus consists of two sections, each receiving energy from a separate section of the 161-kv station bus through step-down transformers. The 4160-volt bus supplies the 4160-volt motors and acts as the primary source for a group of 480-volt unit substations. Each unit substation consists of two power transformers rated 4160-480 volts (one is connected to each section of the common 4160-volt bus), two main circuit breakers, one tie circuit breaker, and a group of feeder circuit breakers. The 480-volt units illustrated in Fig. 1 include one of the two raw water boards, one of the two common auxiliary power boards, and one of the several generating unit auxiliary boards.

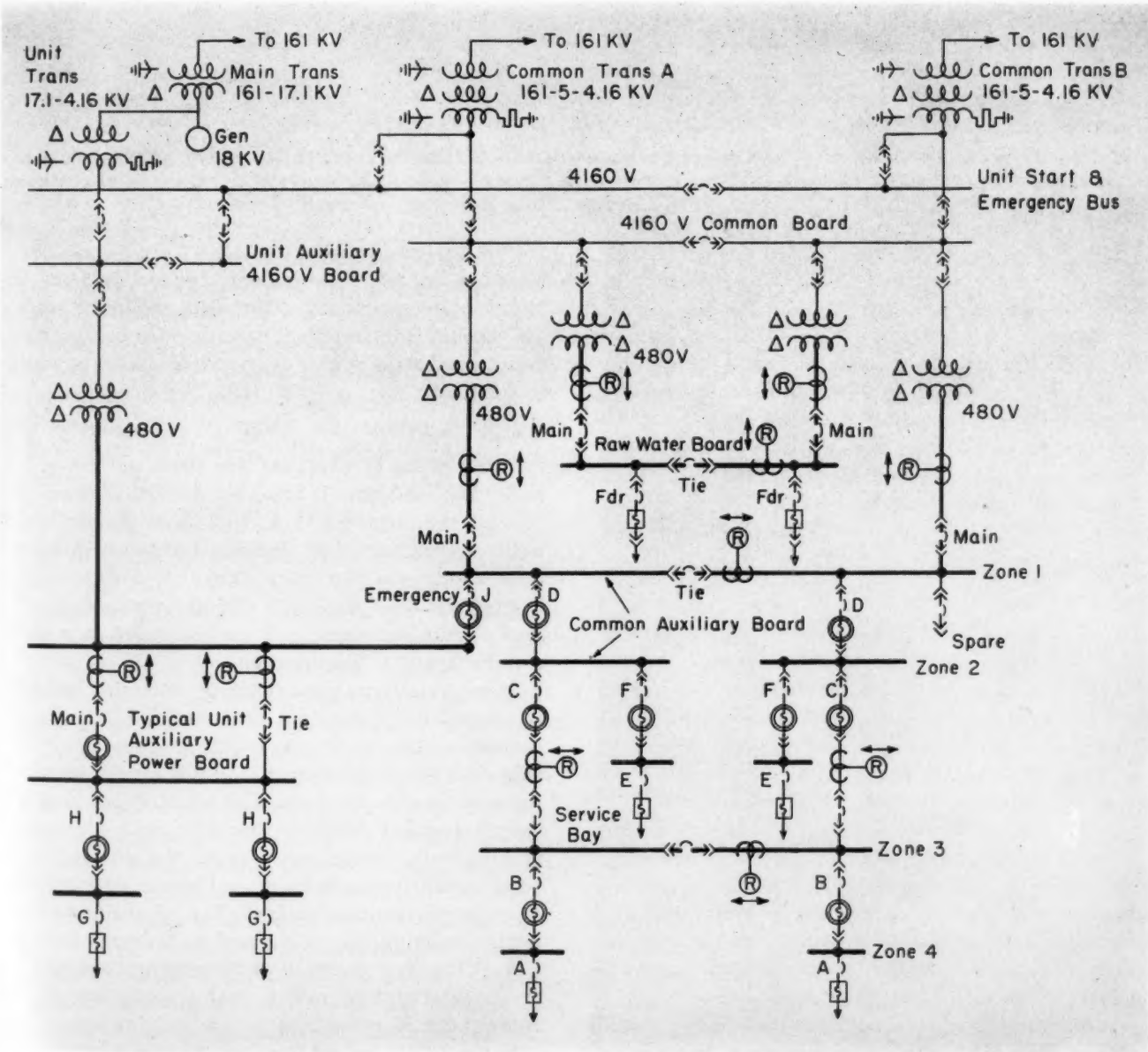


FIG. 1 — PORTION OF 480-VOLT SYSTEM SHOWING AUXILIARY POWER SUPPLY TO 480-VOLT STATION AUXILIARIES AND TO UNIT AUXILIARIES OF A GENERATOR; POWER COMES FROM 161-KV STATION BUS THROUGH 4160-VOLT BUS.

Fig. 2 shows the main connections of one of the raw water boards. It contains the incoming and tie circuit breakers (large air circuit breakers with current-transformer-operated trip devices), the power transformers, and the feeder circuit breakers.

Automatic Throwover

The incoming and sectionalizing breakers have two features: automatic throwover to another source upon loss of the normal source, and rapid fault interruption. With the automatic throwover scheme, used on all principal auxiliary power boards, each piece of tie switchgear is arranged to have two power transformers; each transformer feeds a section of bus through a main circuit breaker with the normally open tie breaker between the two bus sections.

Two types of control are provided. In the manual control, each circuit breaker is controlled by its

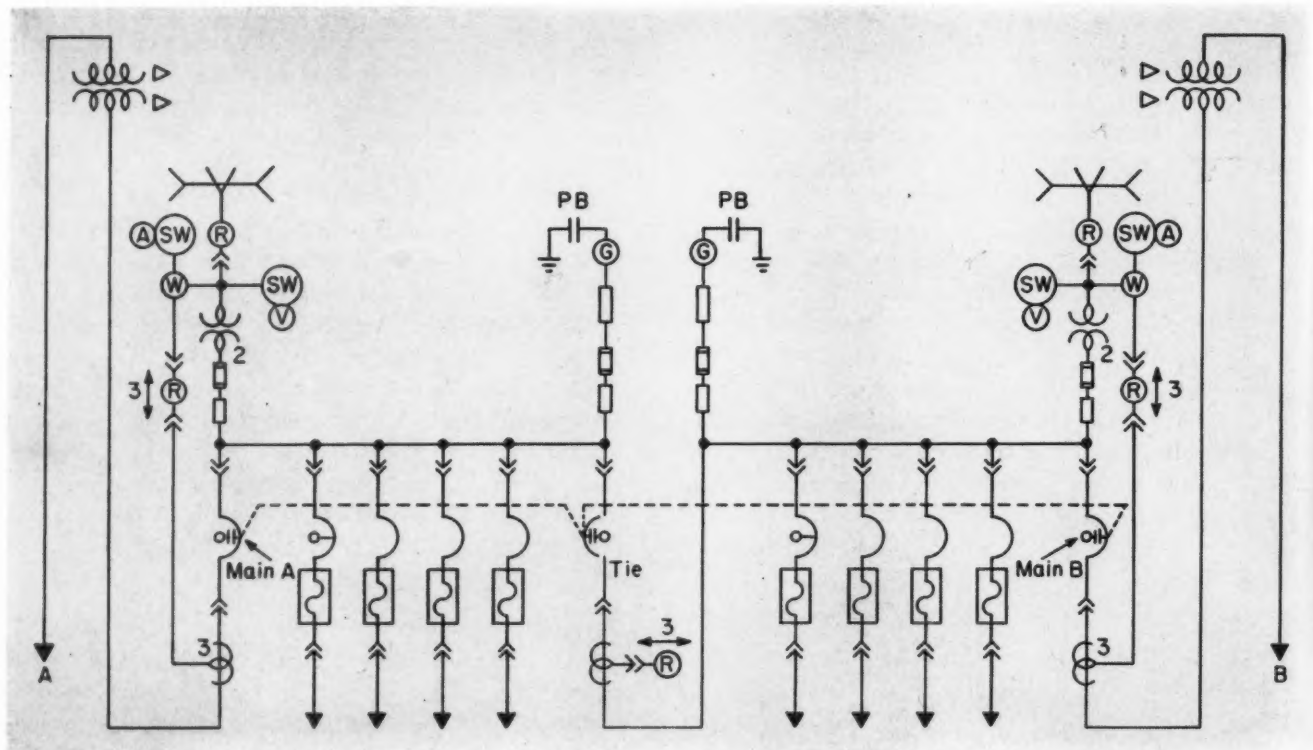


FIG. 2 — MAIN CONNECTIONS OF A RAW WATER BOARD; INCOMING AND TIE CIRCUIT BREAKERS ARE LARGE AIR BREAKERS WITH CURRENT-TRANSFORMER-OPERATED TRIP DEVICES. BREAKERS PROVIDE AUTOMATIC THROWOVER.

respective control switch; upon a voltage failure at either source, the corresponding main breaker opens but the tie breaker remains open. With automatic control, the tie breaker is controlled by the condition of voltage at the two sources. Automatic transfer or retransfer is prevented if any breaker opens on overcurrent. In addition, the two main breakers and the tie breaker are electrically interlocked. In both types of control only two of the three circuit breakers can be closed at one time. Thus the two power transformers can never be paralleled.

Throwover Time

Referring again to Fig. 2, voltage is available from both transformers "A" and "B" under normal conditions. The two main circuit breakers are closed and the tie circuit breaker is open. If voltage fails at transformer "A," the main circuit breaker opens and the tie circuit breaker closes. The entire load is now supplied from transformer "B." The elapsed time from the instant of voltage failure to the closing of the tie breaker is less than five seconds. As a result, motors do not slow down sufficiently to seriously affect the station performance. The return of normal voltage at transformer "A" causes the tie breaker to open and the main breaker at transformer "A" to close, returning conditions to normal.

Automatic throwover is prevented if the initial voltage drop is due to an overcurrent or fault on the bus. The main or the tie circuit breaker, depending on the operating conditions at the time, operates

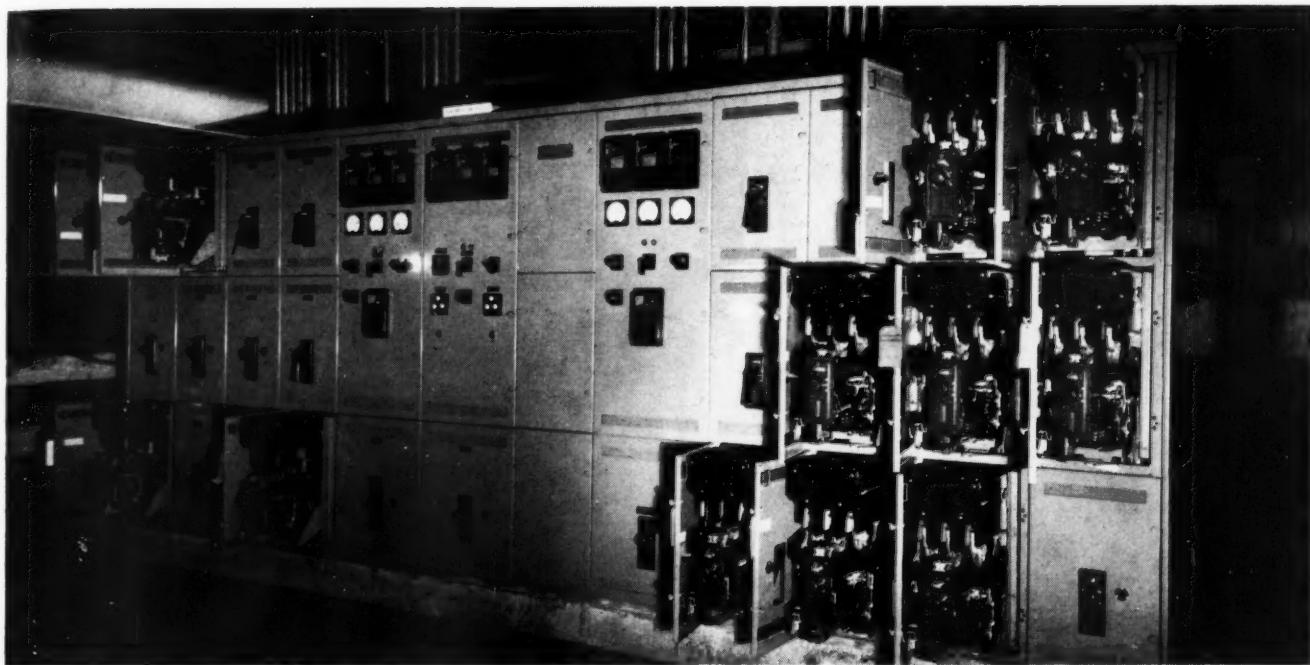
rapidly to remove the faulted bus section from the transformer secondary. This also applies if source "B" should fail. In either case, service continuity is maintained and a source of energy is always available to the load.

Breaker Types

Three types of breakers are used on feeder circuits. The load circuit breakers are the molded-case type or the large air type, with dual thermal magnetic overcurrent trip devices. Large air breakers with dual selective overcurrent trip devices are located between the main circuit breakers and the load circuit breakers; they are employed in a series of selective trip coordinations.

Selective overcurrent tripping of circuit breakers is essentially a problem of isolation. To maintain service continuity, it is essential that any fault current shall cause isolation of only the circuit on which the fault occurs. By the use of selective tripping, the circuit breaker nearest the fault will trip, while other circuit breakers closer to the power source have their tripping delayed and hence, will continue to carry the remaining load. The conditions for selective tripping can be defined as follows: first, the circuit breaker is required to interrupt current up to its interrupting rating, and it must carry that current for 30 cycles.

Second, the circuit breaker in any selective trip system is arranged so that the circuit breaker closest to any fault will interrupt the fault current before



THIS IS THE RAW WATER PUMP BOARD. SOME OF THE CIRCUIT BREAKERS ARE SHOWN IN THEIR DRAW-OUT POSITIONS. AT THE EXTREME RIGHT CAN BE SEEN A TRANSFORMER FROM ANOTHER BANK. SERVICING AND ROUTINE MAINTENANCE ARE MADE EASIER BY THE DRAW-OUT FEATURE, CONTRIBUTING TO HIGH SERVICE CONTINUITY.

any other circuit breaker closer to the source of power can open.

The two previous conditions impose the third: for the system to coordinate properly, none of the time-current characteristics may overlap in the normal operating range. Finally, in order to maintain the condition for no overlap on the time-current characteristic and to keep the tripping time in the short-time range within 30 cycles, the number of circuit breakers that may be applied in series to any load is limited to four.

Board Sections

Each of the two 480-volt common auxiliary power boards (Fig. 1) consists of two sections. The first is a multibreaker main board containing the two incoming and one sectionalizing breakers and several main feeder breakers. One feeder is an emergency supply to the unit auxiliary power boards, and two (one located on each side of the sectionalizing breaker) feed the second or feeder section of the board.

The second section contains circuit breakers, each of which feeds a small distribution board. Two of these circuits (one from each side of the sectionalizing breaker) feed a distribution board in the service bay which contains main and tie circuit breakers arranged in automatic throwover. These circuit breakers do not operate under overcurrent or fault conditions, because this protection is offered by the back-up circuit breakers in Zone 2, and because it is necessary to limit the number of breakers applied in series to four in the selective tripping arrange-

(Continued on page 64)



THE 480-VOLT WATER PLANT BOARD. ALL SWITCHGEAR AND CONTROL APPARATUS ARE ENCLOSED IN VENTILATED CABINETS. NOTE TRANSFORMER IN BACKGROUND.



IN A WELL-EQUIPPED CHEMICAL LABORATORY THESE SCIENTISTS PERFORM CHEMICAL TESTS AND ANALYSES.

The Independent Scientific Laboratory



LESLIE S. FLETCHER, Technical Director
Sam Tour & Co., New York, N. Y.

Col. Fletcher, U.S.A. (Ret.) graduated from West Point in 1924. His army assignments were in ordnance research and development. Prior to retiring in 1947, he was in charge of Artillery Ammunition Development in the Office Chief of Ordnance. Col. Fletcher is also Technical Director of the American Standards Testing Bureau.

INDUSTRIAL RESEARCH expenditures in 1952 reached an all-time high in this country of nearly three billion dollars. Discounting defense projects and inflationary factors, there is strong evidence of a steady trend towards investing an increasing share of our national income in research.

The independent research laboratory offers industry an organized staff of trained scientists and a wide variety of modern instruments and equipment. This staff along with a well-equipped laboratory can be "borrowed" by an industrial firm to work on scientific or technological problems. These facilities become a part of the sponsoring company, helping to solve pressing research problems without overtax-

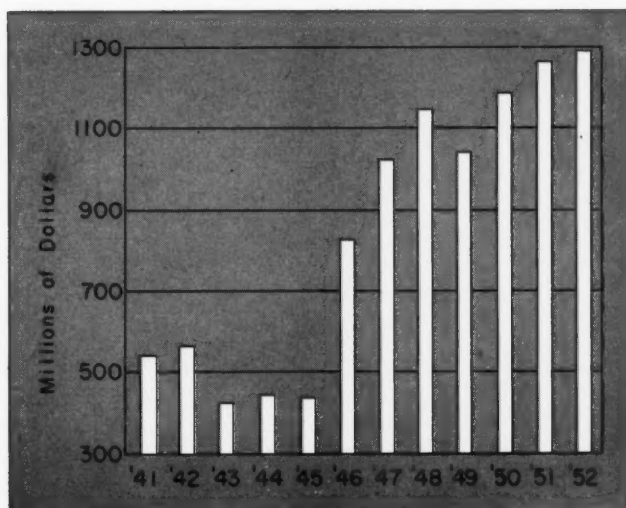
ing the sponsor's facilities or interfering with current projects. Outside assistance can be retained only as long as needed, thereby freeing the sponsoring company from an investment in special personnel or equipment beyond the time of the project.

Available Research Facilities

A 1950 survey by the National Research Council lists more than 800 industrial laboratories that will undertake one or more types of research work for industry or government. Of this number, there are about 300 organizations—located in at least 43 states—whose full-time business is consultation with industrial firms on scientific and technological prob-



A 20-KW HIGH FREQUENCY INDUCTION FURNACE MAKES EXPERIMENTAL METAL ALLOY INGOTS.



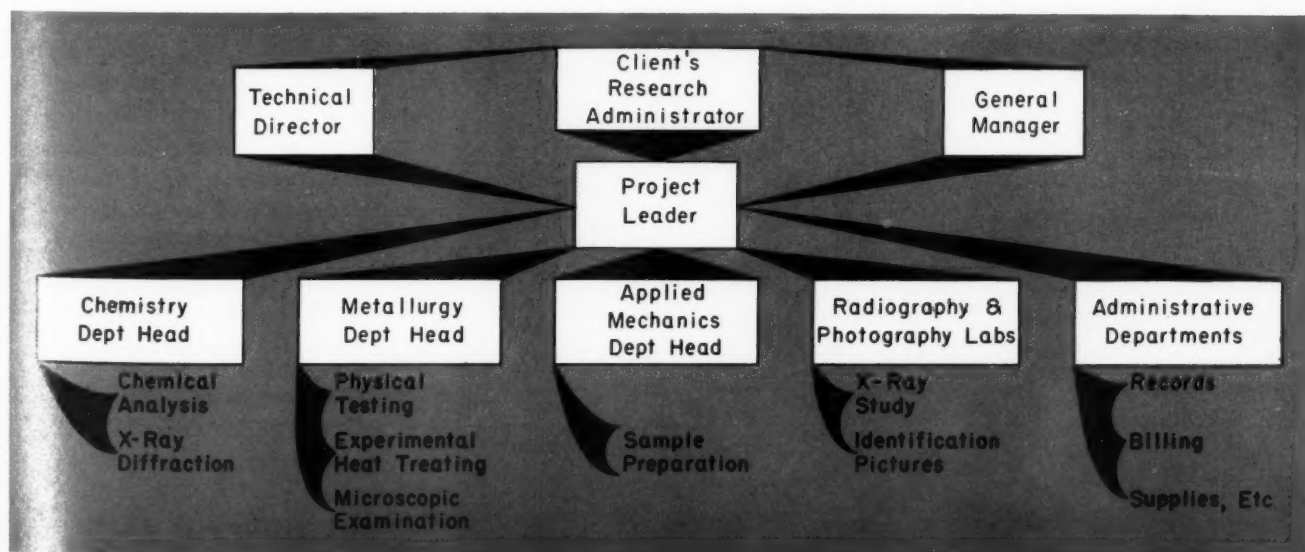
TREND OF RESEARCH EXPENDITURES BY ALL NON-GOVERNMENT SOURCES IN THE PERIOD 1941-52.

lems in almost any field. These organizations frequently work with consulting engineers, doing research for specific projects.

The activities of independent scientific laboratories can be classified according to function. The major categories are: applied research and developments; basic research; trouble-shooting; and testing.

Applied research usually refers to a planned effort

by the researcher to develop a practical product or process. The concept includes fundamental studies undertaken to accomplish a specific and practical objective from which immediate tangible results are expected. The types of projects that may be undertaken are: (1) process research—improving specific processing steps or devising a complete manufacturing process (example: the use of heli-arc welding for assembling thermostats); (2) product research—improving the performance of a product with different materials or design changes (example: the use of surface coatings to increase the hardness of a metal); (3) raw materials research—improving the supply or quality of a material, reducing extraction costs, or developing an alternate source of supply (example: the synthesis of a naturally-occurring



DISTRIBUTION OF RESPONSIBILITY AND FUNCTIONS IN AN INDEPENDENT LABORATORY ENGAGED IN A TYPICAL RESEARCH PROJECT. THE CLIENT'S RESEARCH ADMINISTRATOR HAS DIRECT ACCESS TO THE PROJECT LEADER.



THE ACTIVE INTERCHANGE OF IDEAS AMONG SPECIALISTS PROVIDES FOR A CRITICAL APPRAISAL OF RESULTS.

drug); and (4) waste utilization research—finding uses for waste products or the disposal of these products to eliminate a health hazard or social nuisance (example: alcohol synthesis from waste gases).

Basic research, on the other hand, involves a long-term investigation undertaken to broaden or establish fundamental principles or concepts. Most of this type of work is relegated to the universities and research institutes whose tax-exempt status and fellowship arrangements permit such work to be

done by promising young scientists as part of their education and at considerably less cost.

The remaining categories, trouble-shooting (including investigations) and testing, generally involve short-term projects. In one case, the laboratory investigates the cause of unexpected difficulties in an already developed product or process; in the other, it tests materials and products to ascertain whether they meet standards or specifications.

An industrial research project starts when a com-



METAL SPECIMENS CAN BE STUDIED AT MAGNIFICATIONS UP TO 3000 X ON THIS METALLOGRAPH. THE IMAGE PROJECTED ON THE GROUND GLASS SCREEN IS FROM HIGH PRESSURE EQUIPMENT THAT FAILED UNDER STRESS.

pany or their consulting engineers becomes aware of an existing or potential need. This need may arise within the plant, in the product itself, or in the market for that product. Where applied research is concerned, these needs are easily summarized: (1) to improve a product in order to maintain or expand its competitive appeal on the market; (2) to develop new products or explore new uses for the latest industrial materials; (3) to cut costs by improving product methods, simplifying designs, or using substitute materials; (4) to find uses for waste materials or to develop a satisfactory means of disposing of unusable wastes. Once the need is established, the company must decide whether it is more practical to undertake the project in its own laboratories or to engage an independent laboratory to do the work on a contract basis.

When To Use Outside Research

Some of the major considerations that enter into the decision on whether to assign a particular project to an independent organization are:

(1) Adequate personnel. An industrial plant may not have personnel available to undertake a pressing research project. Perhaps the company's staff lacks the knowledge or experience necessary for efficient handling of the project, or perhaps the appropriate personnel are already being used on other work of equal importance. In either case, before the work can be undertaken, the plant must first solve the problem of obtaining a project team.

(2) Necessary equipment. Most of today's industrial problems require special instrumentation. Most industrial firms either do not have this equipment or do not have the personnel who can exploit the full potentialities of the equipment.

(3) Another perspective. When a few men work on a research project for an extended period of time, they tend to become so engrossed in the details of experimentation that their thinking begins to become channelized. The inability of most individuals to evaluate their own progress and re-examine their objectives with complete detachment can endanger or prolong a research program unnecessarily.

Research men are most productive when they can exchange ideas. The organization of either a large industrial laboratory or an independent scientific laboratory inherently favors this interchange.

Planning the Project

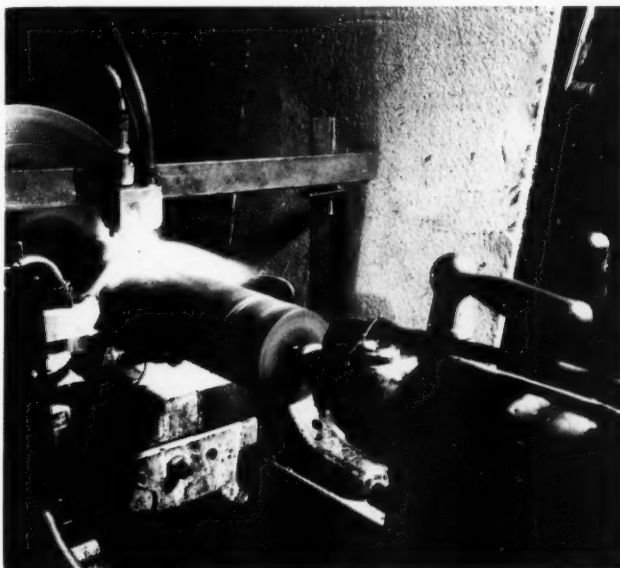
The first step in undertaking a research project is a clear understanding of the problem and the objectives. Next, is selecting the organization to carry out the program of the research aims.

Several agencies have compiled lists of commercial laboratories according to geographical distribution and technical fields or specialization. Such listings are available from the Association of Consulting Chemists and Chemical Engineers, The American

Council of Commercial Laboratories, "A Directory of Commercial and College Laboratories" (Miscellaneous Publication M-187) of the U.S. Department of Commerce, and from "Industrial Research Laboratories of the United States, (1950)" published by the National Research Council.

Exploratory meetings between the responsible personnel from the sponsoring and consulting firm should develop two specific results. The consultant must learn: (1) why the project is being undertaken and what are the known obstacles to its solution—the results of any previous work done on the project should be discussed fully; and (2) what results are desired. The consultant can offer a coherent approach to the solution of the problem only after obtaining a clear picture of what the sponsoring firm wants to accomplish with the research.

Some study and preliminary experimentation may be necessary to permit a clear statement of the



HOT-SPOT MACHINING GIVES LONGER TOOL LIFE WHEN WORKING DIFFICULT-TO-MACHINE METALS.

problem. When a preliminary investigation requires a long period of time, the program leading to understanding the problem actually becomes the first part of the research program.

After preliminary consideration of the problem, the research firm develops a broad outline in which one of several tentative methods of attack are suggested. If this generalized plan of attack is acceptable to the sponsoring firm, the consulting firm works out a more detailed program to outline the problem, describe fruitful avenues of attack, and give a broad estimate of the time required to complete major phases of the program. This proposal will usually

(Continued on page 60)



Engineering Alcoa's Skyscraper

STAFF REPORT

ROUNDED WINDOWS AND INVERTED PYRAMIDAL PATTERN OF THE ALUMINUM WALL PANELS PRESENT A STRIKING ARCHITECTURAL TREATMENT.



PANELS WERE ERECTED FROM INSIDE OF BUILDING.

WHEN ALCOA PURCHASED the Nixon Theatre site in downtown Pittsburgh, early in 1949, and announced plans for a 30-story "aluminum" skyscraper, there was considerable shaking of sage engineering heads. It was almost as though Hershey had decided to construct a tower of chocolate.

With the new building now complete, most of the head shaking has been replaced by nods of agreement and smiles of general approval. Aluminum has long been considered as a practical building material both structurally and economically, but architects and engineers now have, in the Alcoa Building, a large structure in which aluminum has been used in every instance where economy and efficiency indicated its adaptability. Time will prove some applications, and no doubt will disprove others, but there can be little question that Aluminum Company of America has demonstrated a new and huge outlet for their basic product.

Already many of the obviously excellent features have been copied. The new 26-story Tishman Building at 99 Park Avenue, in New York has prefabricated aluminum panels for the exterior building skin, and window construction is much the same as in the Alcoa Building. The speed with which this type of construction can be accomplished was demonstrated when the entire 26 stories of that building were enclosed in only 6½ working days.

Unquestionably, the most striking feature of the Alcoa Building, both to the engineer and to the layman, is its exterior, aluminum panel skin. Each panel

was prefabricated from $\frac{1}{8}$ in. aluminum sheet, measuring approximately 6 x 12 ft. Exterior surfaces have an iridescent gray appearance, imparted by a permanent, electro-chemical finish. The center of the upper half of each panel is stamped out to provide a window opening, while the lower half is impressed with an inverted pyramidal pattern for decoration. The window openings were flanged to receive the frame and sash by the panel fabricator, Pullman Standard Car Mfg. Co. Frames for the windows were built into the panels by the erector, General Bronze Corp.

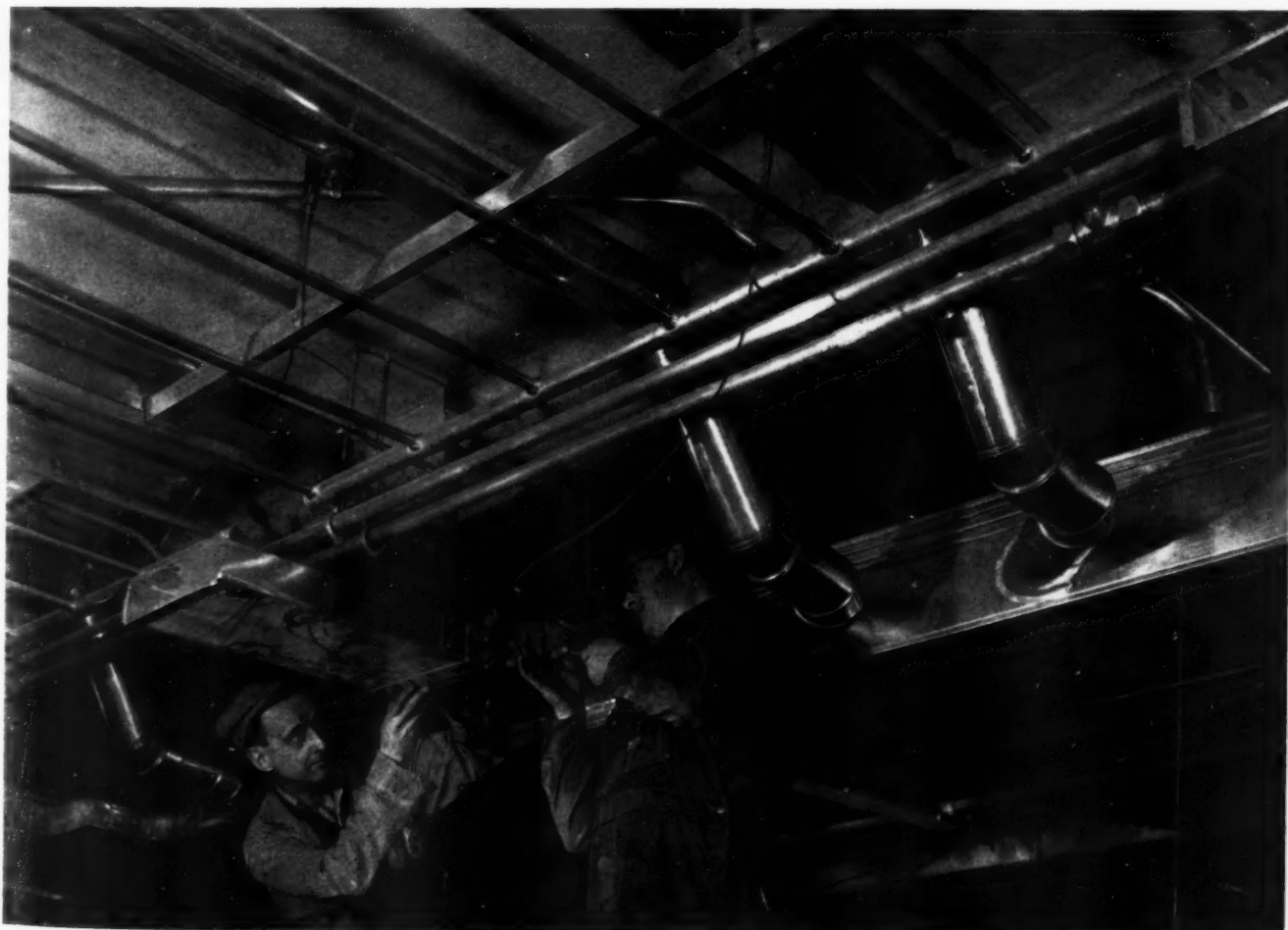
The windows are rounded at the corners, resembling a television screen. In addition to enhancing the building's architectural treatment, the rounded corners were designed to simplify window washing. For insulation, the windows are doubled-glazed, the outer pane being $\frac{1}{4}$ in. thick, heat-absorbing, glare-reducing, plate glass. Important reductions in cleaning costs were accomplished by designing the windows to reverse on vertical pivots, thus permitting all window washing to be handled from the inside of the building. A rubber gasket, inflated by 30 psi air from a portable compressor, is used to seal the windows in their frames. In order for a window to be turned, this gasket must be deflated. A standard tire valve is used for both inflating and deflating. Or-



CLOSE-UP OF REVERSIBLE ALUMINUM WINDOWS SHOWS INFLATABLE RUBBER GASKET FOR SEALING.

dinarily the windows are kept closed and locked by key, being opened only for washing.

After the structural steel was completed, the aluminum facing was erected from the inside of the building. Panels were fastened by bolts to steel clip



PROGRESS PHOTO SHOWS METHOD OF HANGING RADIANT GRIDS. WORKMEN ARE INSTALLING VENTILATING DUCTS.

angles, which were themselves bolted to the spandrel beams. By working from the inside, expensive scaffolding was not required and delays due to bad weather were eliminated. In addition, panel design eliminated taping and caulking of joints.

Lightweight Construction

Aluminum panels are largely self cleaning and are attractive, but most important from the engineering point of view is the weight advantage of this type of construction. Only 6500 tons of structural steel were used, which is 30 to 50 percent less than would have been required of a similar building of standard masonry construction. In contrast, the Gulf Building in Pittsburgh, which contains 6000 sq ft less rentable floor area but is seven stories higher than the Alcoa Building, contains twice as much structural steel. Load on a typical external column is 2,200,000 lb, in comparison with 3,037,000 for masonry design.

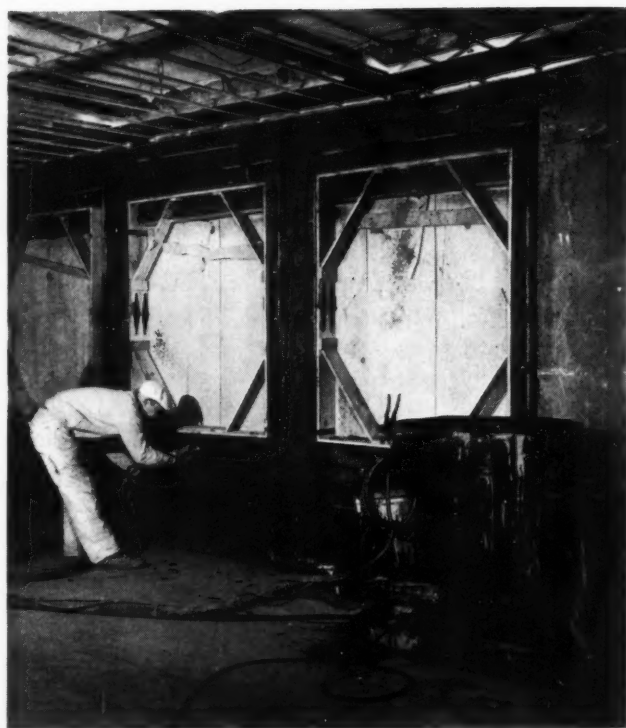
Lightweight construction does not come entirely from the use of aluminum skin. The entire wall construction is designed to provide lightweight combined with good insulating properties. Immediately inside the aluminum skin is a 1½ in. air space for insulation and vapor control. Then comes a slotted aluminum lath positioned by wire clips attaching it to a tensional steel reinforcing mesh. This is covered with a sprayed-on, four inch layer of perlite-concrete (a mixture of cement and lightweight, insulating aggregate weighing 66 lb per cu ft) which was then furred and plastered. This construction provides a wall of about 35 lb per sq ft, as compared with about 150 lb per sq ft for conventional construction. Insulating qualities have been found to be excellent.

The perlite was sprayed onto the lath with four separate one inch thick passes, allowing time for it to harden between each pass. It was found that three, four-man crews could apply the perlite in this manner to approximately four floors per week.

Additional savings in weight were accomplished by using lightweight, foamed concrete to fireproof the building columns and spandrel beams, and for the floor in the service-core areas. Flooring in the office areas, surrounding the service core, is constructed of light-gage, cellular-steel Q-floors, covered by 2½ inches of 2000 psi stone-concrete fill. The floor cells are installed at right angles to the corridors to provide maximum availability to the electrical, telephone, and local signal circuits.

Electrical Features

Power for the building comes from the Brunot's Island Station of the Duquesne Light Company through four, 1000 kva, 3-phase, OISC, subway type network transformers, which are located in a vault below the sidewalk outside the building wall. Secondary voltage from these transformers (208 volt, 3-phase, 4 wire) passes through a 3000 ampere network protector to 4000 ampere air circuit breakers.

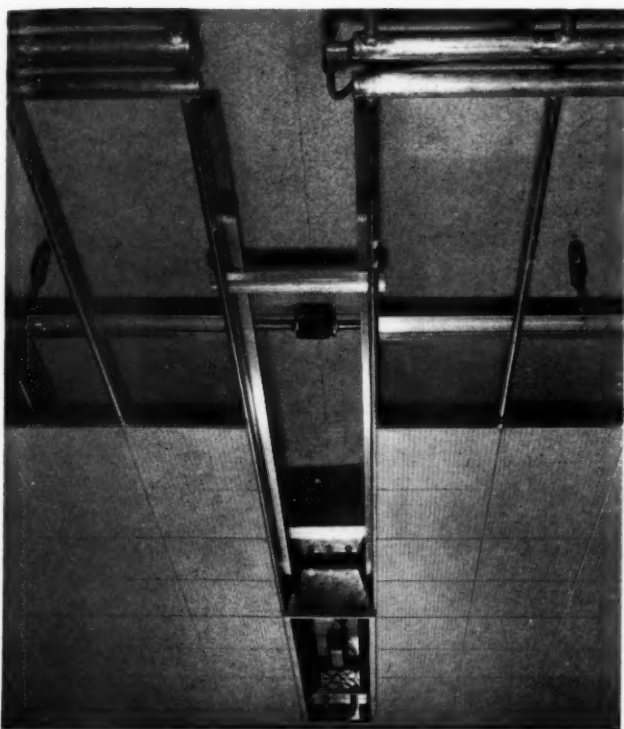


PERLITE CONCRETE WAS SPRAYED ON ALUMINUM LATH AND REINFORCING BARS FOR BACKUP WALL.

Each transformer secondary is also connected to a common bus. From the circuit breakers, the current for all floors above the first goes to low reactance type, aluminum riser buses. Two of these specially designed buses, each completely separated electrically, rise vertically from the basement to the 30th floor to supply current throughout the building. Two other circuits are taken off from the circuit breakers to supply the refrigerating machinery for the air conditioning system. A fifth circuit supplies power equipment in the basement and the sub-basement, as well as stairway lighting, emergency lighting, and other common building services.

The two vertical bus bars running the full height of the building are of unusual design. Each phase conductor is a sector-shaped aluminum extrusion. Use of a Y shape and aluminum made possible a fifty percent weight saving over standard square copper bus. The a-c resistance of each riser is 2.7×10^{-6} ohms per ft, 60 cycle reactance is 7.2×10^{-6} ohms per ft, and the impedance is 7.7×10^{-6} ohms per ft. Connections to distribution and lighting panels are made to each bus on every floor.

The buses, located in an electrical closet, are not enclosed. A rubber curtain can be hung around each bus from permanently installed hooks in the ceiling to permit work to be done safely on one bus while the other is in use. Aluminum bus bars and aluminum wiring are used throughout the entire building so that the basic electrical installation may be considered practically "copperless." About the only cop-



COOLING OF LIGHTING FIXTURES IS PROVIDED BY DIRECT CONTACT OF HOUSINGS AND RADIANT GRIDS.



END VIEW SHOWS ONE OF TWO EXTRUDED ALUMINUM BUSES USED TO SUPPLY CURRENT TO BUILDING.

per in the electrical system is in the electrical fixtures, which are copper wired. When connecting aluminum wires to copper terminals, a spring cup washer was used to absorb the uneven expansion. A joint compound eliminates moisture and electrolytic corrosion.

Radiant Heating and Cooling

Heating, ventilating, and air conditioning specialists will find the Alcoa Building an excellent testing ground for new ideas. This is one of the first instances in which radiant cooling has been combined with radiant heating in a major installation, and it is the first time aluminum has been used for the radiant coils. Cooling in this building is accomplished by a combination of radiant panels and air circulation, while heating is carried principally by the panels.

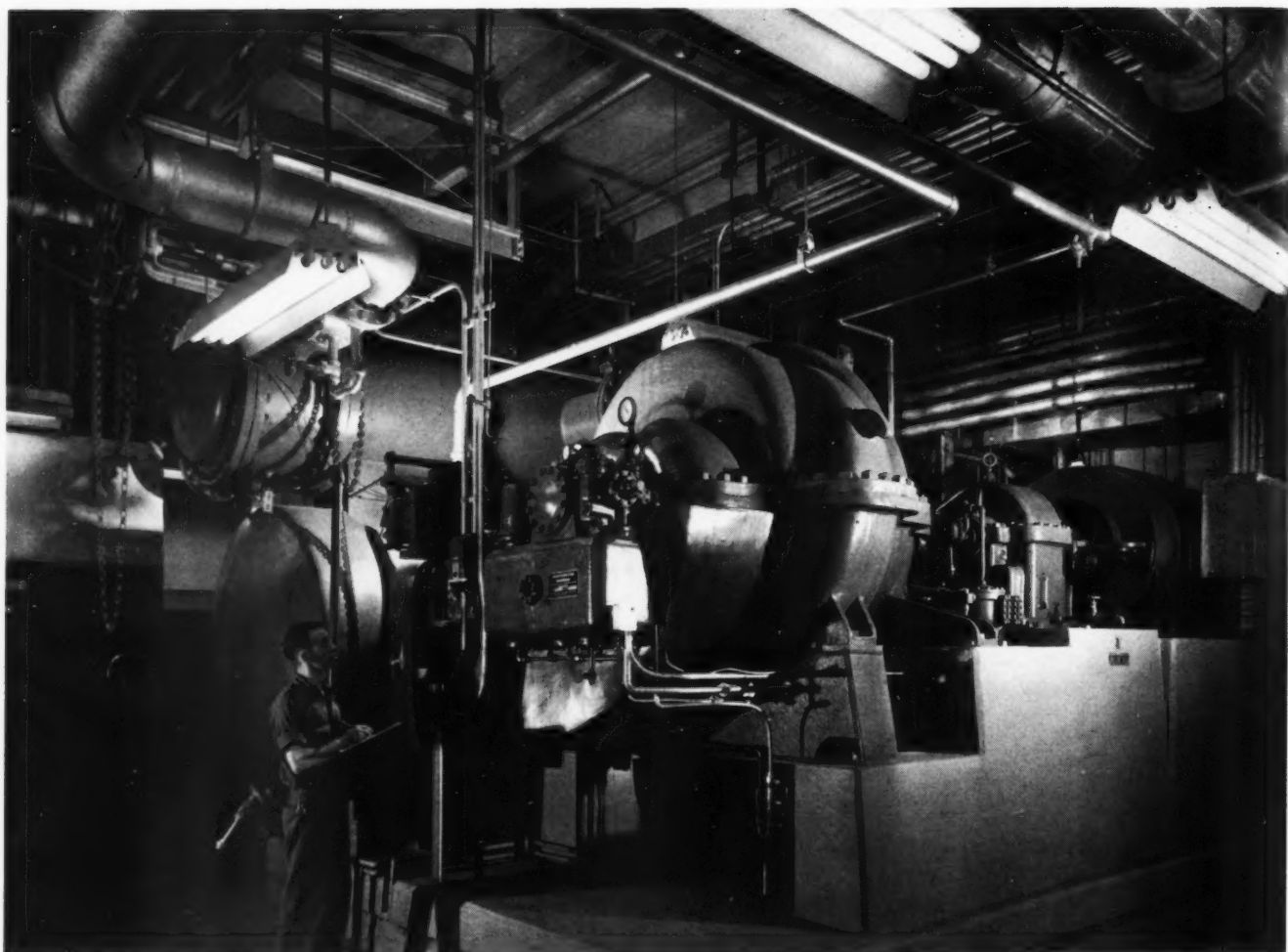
The air circulation may be considered a true ventilating system. Outside air is warmed in winter, cooled in summer, and brought to proper humidity conditions. It is then combined with recirculated air for distribution throughout the building. Summer or winter, this air is supplied to the floor areas from one of four central air conditioning systems. One of these is in the basement, two are on the 14th floor, and one is in the penthouse. Since the ventilating air is kept constant at the relatively low temperature of 62 degrees, some heating is required at all times except in midsummer. This heating (and additional cooling, when needed) is handled by the radiant pans in the ceiling.

Radiant heating and cooling grids, each 6 x 12 ft, were prefabricated from $\frac{1}{2}$ in. aluminum tubes extending on 12 in. centers from $1\frac{1}{4}$ in. headers. Turnbuckle hangers threaded to a steel pencil rod system support the fireproof ceiling, which itself supports the radiant grid. A $\frac{3}{4}$ in. acoustical insulating blanket has been laid over the grids, leaving approximately a foot of air space between the insulating blanket and the suspended fireproof ceiling above. This area is used as a return air plenum for the ventilating system. The radiant ceiling constructed of 0.04 in. thick aluminum panels, each measuring 1 x 2 ft, is clamped directly to the radiant grids. Heat is conducted to and from the grids directly through these clamps. Approximately 9 percent of each panel is perforated for sound absorption. This is a Burgess-Manning type acoustical and radiant ceiling. The bottoms of the panels are covered with a white paint of high emissivity, while the tops are left bright.

Nearly $\frac{3}{4}$ of the ceiling in the office space is covered with radiant grids. The remainder is occupied by lighting fixtures, air diffusers, return air grills, and access panels.

A refinement of the design is the handling of lighting fixture cooling. The fixture housings are in direct contact with the grid pipes so that heat from the fixtures is transferred directly into the radiant tubing for cooling at the source.

On every floor the radiant tube system connects with a heat exchanger located in a service room in the center of the office area. Four heat exchangers



ONE OF TWO 625 TON REFRIGERATION MACHINES USED TO COOL PRIMARY WATER FOR THE RADIANT COOLING SYSTEM.

are used on each floor, one for each of four thermostatically controlled temperature zones. These heat exchangers are supplied, on the primary side, with hot water in winter and with cold water in summer. The temperature of the hot water may be carried to as high as 140 F in winter and as low as 43 F in summer. In the heat exchangers, the primary water tempers secondary water in the grids, which varies between 130 and 60 F to heat or cool office areas.

It should be noted that this radiant system only heats or cools as an addition to the constant 62 F air being supplied through the ventilating system. Because of the excellent insulation of the building, it has been found that slight heating rather than cooling is required even on rather warm days.

The primary water, which supplies the four zone heat exchangers on each floor, is heated in winter in a large steam-water heat exchanger located in the basement. Steam is purchased from the Allegheny County Steam Heating Co. In summer, the primary water is cooled by two, motor-driven refrigerating machines, also located in the basement. Worthington centrifugal compressors, rated at 625 tons each, are used. Cool condenser water is supplied from an aluminum cooling tower located on the roof.

There are several advantages to the combination ventilating-radiant system as used in this building. First, in a completely sealed building, some ventilation is obviously necessary. By using the radiant panels, however, the volume of air to be handled, and consequently the amount of ductwork required, has been cut approximately in half. The reduced volume of air also means smaller blowers and reduced air washing and filtering. Then, too, the radiant system provides, most experts agree, the most comfortable type of heating and cooling.

While the air system and the radiant system are each designed for a minimum capacity of 55 percent of the cooling, it is estimated that the radiant cooling takes care of 45 to 55 percent on the hottest days.

This system completely eliminates the use of any wall radiators or air outlets, which means a considerable saving of rentable office space. Alcoa engineers have calculated a savings of 1½ floors by using thin wall design and by eliminating wall heating fixtures.

Plumbing

Water piping, as well as the radiant grids, is of aluminum. However, it was not economically feasible to specify all plumbing fixtures and certain valves of

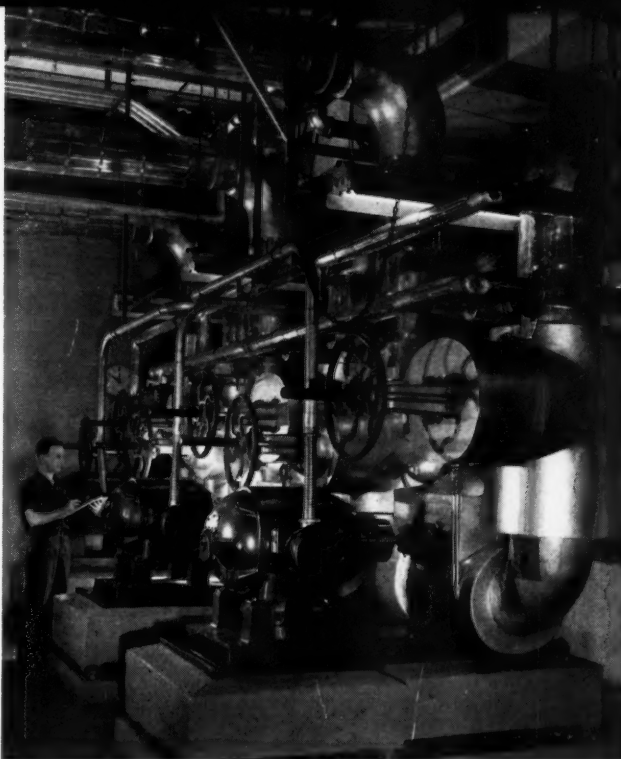
aluminum, so standard brass fixtures and copper branch lines were used. This brought up two interesting engineering problems. Two or more metals in a water piping system suggests electrolytic corrosion. Since aluminum and copper or brass are particularly susceptible, a system to simplify maintenance was worked out which minimizes and controls corrosion, but does not completely eliminate it.

Wherever aluminum pipe joins a bronze or copper fitting, a special "sacrificial" fitting of pure aluminum, having a nonconductive gasket at each end, is inserted. This arrangement is expected to prevent the flow of electrical current, and to confine corrosion to the pure cathodic insert of aluminum, which has heavy wall construction. Although expensive, Alcoa engineers point out that it would not be necessary in an all-aluminum system, and that fittings of aluminum will be no more expensive than copper or bronze when manufacturers are set up to make a complete line on a production basis.

A second, and very closely allied problem, is water treatment. Once again the problem is made more difficult by the use of poly-metallic piping. If all plumbing had been aluminum, water treatment would have been simple. As it is, some of the treatments used for steel, copper, and bronze, are not suited to aluminum. The reverse is also true. However, the problem has been overcome in the Alcoa Building installation. Their engineers recommend that any prospective users of poly-metallic piping involving large amounts of aluminum make use of Alcoa's extensive water treatment research. Basically, their findings show aluminum is resistant to scaling and pitting and, with most waters, comparatively little treatment is needed.

Noise Control

One of the few problems encountered in the building (and a relatively minor one) has nothing to do with aluminum. Every effort was made to make the



THESE CHILLED WATER CIRCULATING PUMPS SUPPLY ALL FLOORS AND ALL AIR CONDITIONING UNITS.

building as soundproof as possible. The type of wall construction, the acoustical ceilings, the sealed windows, and the heavy carpeting worked so well that the general noise level has been reduced to a remarkably low level. Outside street noises are inaudible within the office areas. The noise level was found to be so low, however, that sound in one office could be heard in adjoining offices.

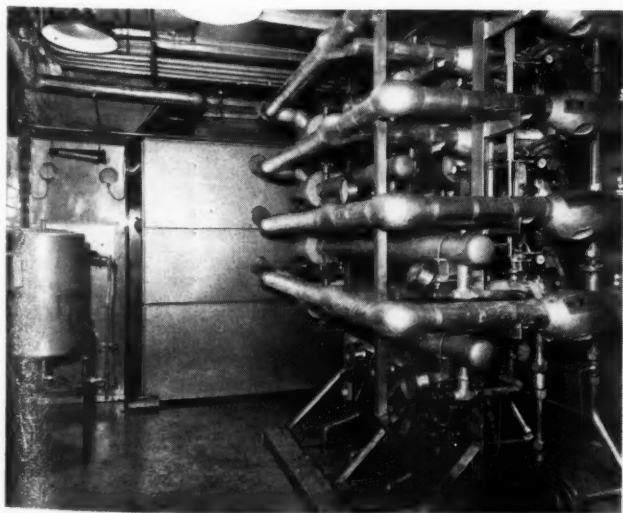
To overcome this, partitions between offices were extended through the radiant panel ceiling to the actual ceiling above. Since the space above the radiant ceiling is used as a plenum for return ventilating air, the partitions had to be vented. Simple open vents, however, still allowed voices to travel between offices. The solution involved acoustically treated ductwork, with upwardly directed outlets at each end, installed through the partitions.

Cost

Undoubtedly the extensive use of aluminum and the time and money which went into development increased the over-all cost of this building. On the other hand, such features as the aluminum outer skin and the thin wall construction actually reduce building cost because of savings in labor and materials.

Finishing costs cannot be compared, for the Alcoa building is so sumptuously decorated that there are few office buildings in the same class. It does, however, provide a showplace for aluminum as a decorating device and a giant testing place for aluminum as a structural material.

Now that much of the pioneering is done and much experience has been gained, other buildings can be engineered on the basis of this example. The building may establish a trend in design and construction.



HEAT EXCHANGERS IN SERVICE ROOMS ON EACH FLOOR SERVE EACH OF FOUR COOLING ZONES.



PREVAILING CODES LIMIT THE ANGLE OF INCLINATION FOR MOVING STAIRWAYS TO THIRTY DEGREES. STEEPER UNITS WOULD OCCUPY MUCH LESS SPACE HORIZONTALLY.

W. S. G. O. S. E.

Steeper Moving Stairways Make Sense

**G. B. GUSRAE, Vertical Transportation Consultant
Voorhees Walker Foley & Smith**

ALL PREVAILING CODES governing design of moving stairways in this country, including the current American Standard Safety Code for Elevators, Dumbwaiters and Escalators, have one provision in common. Each states, "The maximum angle of inclination of an escalator shall be thirty degrees from horizontal."

With present day design of moving stairways, a number of advantages would be gained by increasing this angle. What, then, is the origin of the thirty

degrees, and why has it been retained as a law?

The beginning of the moving stairway is closely linked with two men, Jesse W. Reno and Charles D. Seeberger. Both perfected their designs at approximately the same time.

Reno's device was an inclined endless belt to which were attached cleats approximating steps. In the original design, the cleat steps were inclined at the same angle as the belt. Subsequently, the design was changed and the steps were inclined at an angle of half that of the supporting belt inclination. Reno took out a patent on it in 1891, formed a manufacturing company, and on September 5, 1900 he installed his first unit at the 59th Street Station on the Third Avenue "L" in New York City.

The unit is still in operation. It measures 65 ft, has

a rise of 24 ft, 1 7/8 in., is 18 in. wide, and is inclined at about 25 degrees. Reno called his device an "inclined elevator."

The day after Reno's elevator went into operation, the New York Tribune reported that "a few thoughtful women got on with heavy baskets and held them until they reached the top, thinking perhaps, that in this way they were relieving the elevator of some of the burden."

Lyman G. Bloomingdale, the proprietor of Bloomingdale's, invested in Reno's company, and an inclined elevator was installed in his store in 1901. Thus the Reno inclined elevator became an immediate success and even today, many of the early units are still being used.

In the meantime, Seeberger was perfecting a more elaborate contrivance with folding and unfolding, solid, horizontal steps. He coined the word "escalator," probably with the words "escalade" or the Latin "scala" and "elevator" in mind, and sold his invention and its name to the Otis Elevator Co. The Seeberger escalators were built at an angle of approximately 26 1/3 degrees.

Otis installed their Seeberger type escalator at the Paris Exposition of 1900, a few months before Reno finished his inclined elevator at the 59th Street "L" Station. After the exposition, Otis brought their escalator back to the United States and installed it in Gimbel's Department Store in Philadelphia, where it operated until 1946.

About 1907, the inclination of the Seeberger type escalator was standardized at 30 degrees. In 1911, the Otis Elevator Co. bought out the Reno Co., and in 1921 it brought forth the first level step, cleat type escalator, combining the best features of the Reno and Seeberger devices. This design was substantially the same as that employed today. The inclination of 30 degrees was retained throughout.

Origin of the Thirty Degrees

This sketch of the development of moving stairways leads to speculation upon the origin of the 30 degree inclination. The clue lies in the design of the first Reno inclined elevator.

In any design employing inclined surfaces, two factors must be given proper consideration: the angle of static friction and the angle of sliding friction. The angle of static friction is the inclination angle of a surface on which a body will just begin to slide under the action of its own weight. For such materials as leather on oak, this angle varies between 26 1/2 and 31 degrees.

The angle of sliding friction is the inclination angle of a surface on which the motion of a body sliding upon it will be maintained. For leather on oak, it varies between 16 3/4 and 26 1/2 degrees.

Considering these factors, any surface designed for a person to stand upon without slipping must be inclined at less than 16 3/4 degrees, since the person



Otis Elevator
SEEBERGER'S FIRST ESCALATOR, A FLAT STEP TYPE,
AS IT APPEARED IN THE 1900 PARIS EXPOSITION.



Otis Elevator
RENO'S FIRST INCLINED ELEVATOR, INSTALLED
IN NEW YORK CITY IN 1900, IS STILL IN USE.

FIGURE 1—HORIZONTAL SPACE REQUIREMENTS OF A FORTY DEGREE MOVING STAIRWAY ARE COMPARED TO REQUIREMENTS OF A 30 DEGREE UNIT WITH EQUAL VERTICAL RISE.

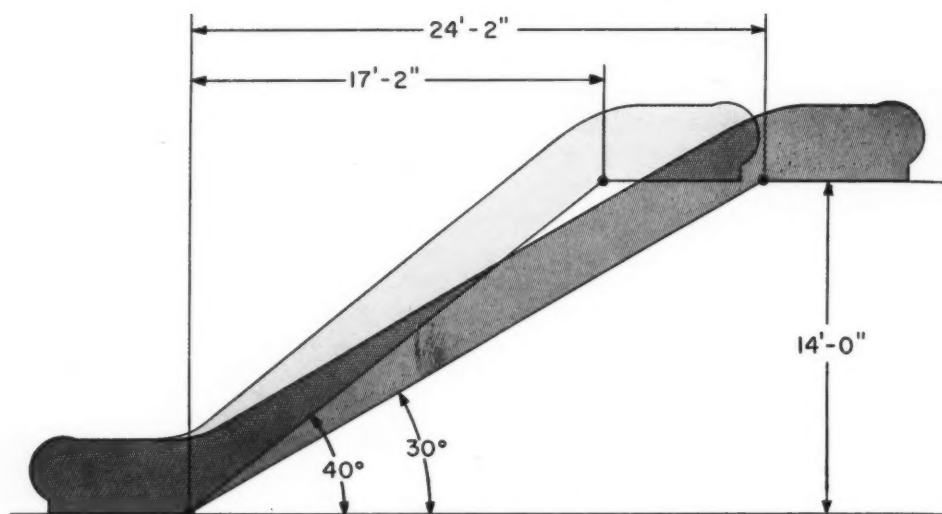
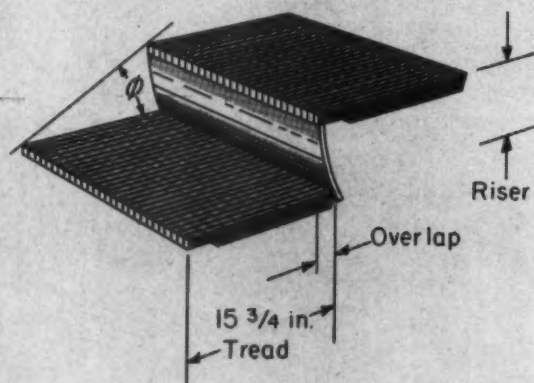


TABLE 1— PROPORTIONS FOR MOVING STAIRWAYS BASED ON 15 3/4 IN. TREAD



Angle (ϕ) degrees	Riser inches	Overlap inches
30	8	2 1/8
32 1/2	8	3 1/2
35	9	3
37 1/2	9	4
40	10 3/4	3

will start sliding under the action of his own weight at an inclination between $26\frac{1}{2}$ and 31 degrees, and once started, he will continue to slide unless it is righted to less than the angle of sliding friction.

Reno used inclined steps in his design. He therefore solved his problem by inclining the steps at $12\frac{1}{2}$ degrees, or less than the angle of sliding friction, and generally inclined the entire elevator at the maximum angle he dared: at 25 degrees, or less than the angle of static friction. While this is admittedly a surmise, it is the most likely explanation for Reno's choice of the 25 degree inclination.

In the Seeberger design, the flat top of the steps

became horizontal. Here the friction angle consideration did not apply, and yet the 25 to 30 degree inclination was unnecessarily retained. From then on, the 30 degree inclination became a tradition.

One can readily appreciate the force of this tradition and its compliant retention through the last 60 years, backed by the successful history of its acceptance and survival. Nevertheless, this may be the time to evaluate the merits of the limitation placed upon the angle of inclination, and to ask the question "Should the 30 degree moving stairway be retained because tradition so wills it, or is there a good reason for changing the angle?" Furthermore, if there is a reason, what angle should be chosen?

Advantages

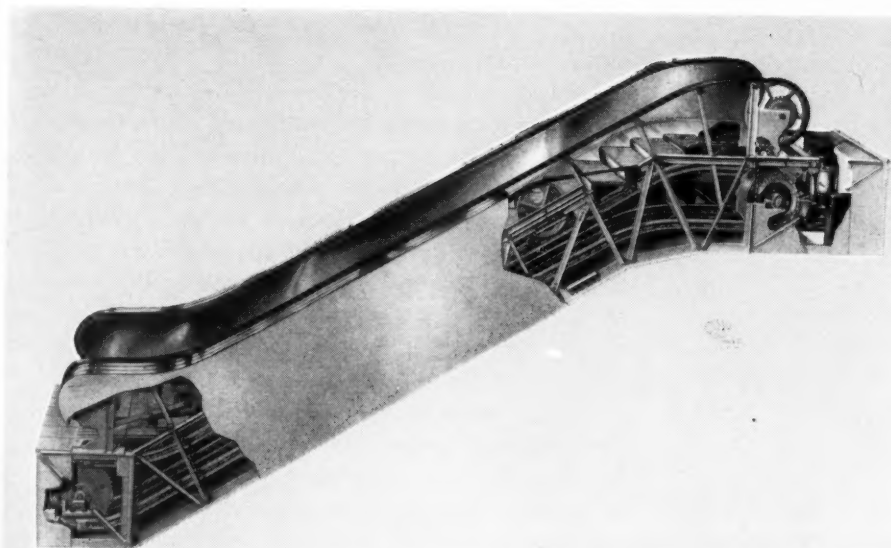
It may be stated at once that there are at least three very good reasons for increasing the angle.

A moving stairway steeper than 30 degrees will save building space. This is of considerable importance in all instances, and often may permit the installation of a unit in a space too short for the 30 degree type. A 40 degree unit would occupy 20 to 25 percent less building space lengthwise.

Steeper units, being shorter in length, will use less

TABLE 2—PROPORTIONS FOR STATIONARY STAIRS

Approximate slope degrees	Riser inches	Tread inches
29	6 1/2	11 5/8
31	6 3/4	11 1/4
33	7	10 3/4
35	7 1/4	10 1/2
37	7 1/2	10
39	7 3/4	9 5/8
41	8	9 1/4
44 1/2	8 1/2	8 5/8



DETAILS OF DESIGN
AND CONSTRUCTION
ARE SHOWN IN THIS
CUT-AWAY VIEW OF
A PRESENT-DAY
MOVING STAIRWAY.

Westinghouse

labor and materials in the truss, step guides, step chains, handrails, balustrades, and in the number of steps. This saving would contribute to lowering of the initial manufacturing cost, as well as to reducing

the cost of installation, and thereby should encourage a more widespread use of moving stairways.

At identical linear speeds, steeper units will have faster vertical speeds. As an example, the 30 degree



Otis Elevator

INCREASING THE ANGLE OF INCLINATION WOULD INCREASE VERTICAL SPEED WITHOUT CHANGING LINEAR SPEED.

moving stairway has a vertical speed of 45 fpm at the standard 90 fpm linear speed. The 40 degree unit would have a vertical speed of 58 fpm for the same 90 fpm linear speed, or practically the vertical speed of the 30 degree moving stairway traveling at 120 linear feet per minute.

These advantages justify the serious consideration of the possibility of departing from the traditional 30 degree inclination.

Comparisons

In comparing actual dimensions, the basic 30 degree installation, based upon a 14 ft vertical rise shown in Fig. 1, has a horizontal distance between points of 24 ft. 2 in., while a 40 degree unit would have a horizontal distance of 17 ft. 2 in. The 30 degree unit has 21 steps, while the steeper unit would have approximately 15½ steps.

Possible dimensions of moving stairways with steeper angles of inclination are compared with the present 30 degree installations in Table 1. The basic 15¾ in. width of the steps has been retained throughout. This is important. Moving stairways inclined at 35 degrees have been and are still being built in Europe. J. E. Hall in London, England, manufactures both 30 and 35 degree equipment. Unfortunately, in the European 35 degree design, the height of the step riser was maintained at 8 in. and the width of the steps was reduced accordingly. Consequently, the European manufacturers have experienced difficulties with their steeper moving stairways due to insufficient step surface to safely accommodate the length of the human foot.

Comparison of the 40 degree moving stairway with the basic 30 degree, in relation to the dimensions and equipment between the working points, indicates decreases of 29 percent in occupied lengthwise space, 26 percent in the number of steps, 20 percent in length of truss, step guides, step chains, handrails, and balustrades, and 29 percent increase in vertical speed for the same linear speed. Since the sizes and number of component parts would be decreased, total load also would be lessened, which would result in a decrease of required horsepower for the driving motor.

Why Forty Degrees?

The advantages of steeper moving stairways are so marked, and the feasibility of their construction is so real, that the eventual departure from the basic 30 degrees is inevitable. The exact angle of inclination, however, remains to be decided upon. The most obvious precedent would be the present-day, generally accepted slope of stationary stairs.

There are many rules governing the proportioning of stationary stair risers and treads. There is one where the sum of the riser and tread should equal 17½ in. Another requires that the sum of two risers and one tread be equal to 25 in. Some employ trigonometric functions. The oldest and most popular rule

is one where the product of a riser and a tread, in inches, is equal to 75.

Table 2, based on the latter rule, compares riser and tread dimensions for stationary stairs with varying slopes. The proportions indicated for 37 and 39 degree slopes are most popular as a happy compromise, combining reasonable comfort in climbing with maximum economy in space and cost. These slopes have been generally accepted by builders and by the public. Consequently, a slope for moving stairways which approximates the above—about 40 degrees—is likely to be the most acceptable to all.

Even greater inclination angles are a possibility. The maximum slope of stationary stairs is 50 degrees. Stairs with slopes exceeding this angle are classified as ladders. This limitation does not apply to moving stairways, however, since they are not designed for climbing. There appears to be no reason why 50 degree units should not be built, provided the step treads are properly sized. The height of the risers is immaterial. In fact, a high step riser is desirable to discourage walking, thus dispensing with one important cause of accidents on moving stairways.

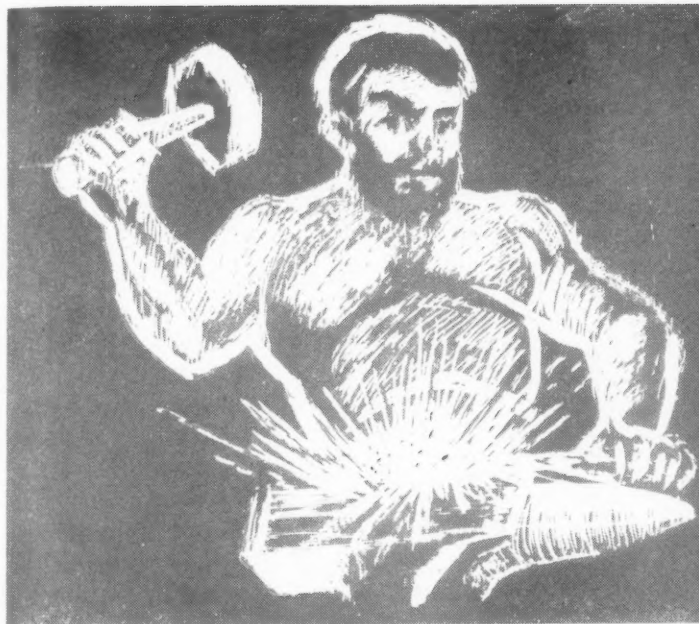
Additional Advantages

Once the idea of the 40 degree moving stairway is accepted, further advantages will become apparent. For instance, in department stores and wherever vertical speeds must be held at 45 fpm to accommodate a given volume of passengers, a slower linear speed will be possible. The linear speed will be 65 fpm, as compared to 90 fpm for 30 degree units.

The advantages of the 40 degree moving stairway would be particularly reflected in high rise units. For example, in an escalator installation with a 60 ft vertical rise, about 30 ft of space would be saved lengthwise between the working points. In addition, the truss, step guides, and balustrades would each be about 25 ft shorter, the handrails and step chains would be about 50 ft shorter, about 45 fewer steps would be required, and the vertical speed would be increased nearly one-third, with a smaller size motor at a lesser expenditure of electrical energy.

Tradition is an admirable concept if it serves a useful purpose. The sanctity of the traditional 90 fpm linear speed has been invaded, and today higher speed moving stairways are on the way to becoming commonplace. The sanctity of the traditional 30 degree inclination should be no greater. The invasion of this tradition by the progressive elements of the moving stairway industry is hopefully and eagerly anticipated in the near future.

This is the second article which Mr. Gusroe has authored for CONSULTING ENGINEER. His first article, "Ancient Lifts to Passenger Conveyor Belts," appeared in the March, 1953 issue.



As technology changes, so do markets change; well-chosen market studies of clearly defined scope provide valuable counsel to those responsible for the success of an enterprise. Such studies indicate the best places to concentrate engineering efforts.



How to Own a Market

PAUL E. JACOBS

The Trundle Engineering Company

"I'D RATHER OWN a market than a factory," a prominent automotive executive said recently. Certainly, that statement needs no elaboration or explanation; its wisdom is obvious. And just as obvious is the question, "How do you manage to own a market?"

Competition in our highly ingenious and fluid economy will permit a new product or service to own a market only temporarily. After the initial brief tenure of exclusive ownership, the value and accept-

ance of the originator's product will determine how large his sustained share will be.

Constant research for new applications of a product combined with current market information will broaden the acceptance of the product and strengthen the chances of its continued manufacture. Nylon replaced silk for women's hosiery and lingerie. It became the accepted textile for parachutes and glider tow lines. Adopted by the tire industry, it was used for cord. With each new application, nylon claimed a larger and larger textile market. Though nylon has grabbed a huge share of the market, newer synthetics are now making their presence known.

What, then, is the link between the market and the market study? The answer is two-fold and differs for new products and for products long on the



MODERN MACHINES LOWER COSTS, FORCING ALL MANUFACTURERS TO FOLLOW LEADER IN THEIR USE.

market. Considering a new product, the program of manufacture and sales will depend on the product's acceptance by the industries or consumer groups at which it is aimed, its merits compared to those of the products it is expected to replace, its cost of manufacture, and its selling price.

The answers sought of the market study, if the product is an old one are: is the product getting its share of the market; can its share be increased; is it losing its share of the market.

Factors of sales coverage, sales calls, servicing, sales promotion, design, packaging, and the many others which affect the position of a product in its field show up in a comprehensive market study.

Experience shows that capital goods sales cannot be forced; that is, a market cannot be created except in a limited sense. A manufacturer cannot be sold an eight-position turret lathe if he can produce his product economically on a six-position lathe. He may buy an eight- or a ten-station lathe if he can be shown labor savings or production cost savings with which to write off the expenditure in a reasonable time. If for example, one machine will replace three others, just as a machine replaces three or four men, he may buy. Then, because of his lowered production cost and lower selling price, his competition will be forced to follow, and a market is created.

Major capital goods follow industrial and economic cycles. A company does a great deal of thinking before spending \$150,000 for ten machines. But a company may not hesitate to buy 30 pumps at \$40 each if the pumps are better than those currently being used and can be written off quickly through a marked decrease in maintenance costs. In smaller capital goods, there is a possibility of forcing the market.

Industrial expendable goods can be forced, but here, too, they can be forced only on the merit of the product. A coolant which will preserve the life of cutting tools, cool more efficiently, and speed the cut-

ting process can be forced so that it replaces an inferior coolant.

Consumer Goods

Consumer durables and expendables are the hoop-la and hullabaloo field. Here a market is created; here is the area of creative selling. Recall the old ice-box; it was followed by the electric refrigerator; then one which made ice cubes, put them in a tray, and defrosted itself; then one that does all that and has a built-in food freezer; and the one of tomorrow will do all that plus mixing cold drinks. And with each new development of the product comes the campaign of how you can't live without it.

The markets of the consumer expendable are much the same, but the turnover is faster. The kids are torn between the brands of bread that Hoppy and Howdy Doody eat. And Space Cadet, remarkably enough, is eating the very same cereals in his world of the future.

The consumer markets are subject to economic cycles too, but we have come to the realization that consumer items can be forced—from bubble gum to atomic eights with the "new" wire spoke wheels. But turret lathes, boring mills, drill presses, overhead cranes, and hydraulic presses can't be forced.

Simply, the market study tells the manufacturer if he should attempt to force a market for his new product. If the manufacturer sees a profitable future for the product, then he's in business. If not, he can save a lot of money by forgetting the whole thing.

In the case of the old product, the market study will specifically answer present and future status in the market. But it must be borne in mind that markets are dynamic and the market study also must be dynamic. Markets are thinking, changing things, and the manufacturer must also be thinking and changing to keep pace with the market. It's the market study that catalogs the thinking.

Depth Interview

While the depth interview is the meat and potatoes of the method, one of the most significant phases of a market study is the preliminary discussion between the engineers and the management of the client company. Complete understanding between the two is essential, so that the entire project—its scope and its objectives—is clearly defined.

Following the initial meeting, the engineers gather all the pertinent basic data of the industry or business to be studied. This includes historical matter, current trends, facts and figures of supply and distribution, plus data from government sources, trade publications, and trade associations.

The field men start their contact work under the supervision of a project engineer. The degree of concentration and the size of the sample have already been determined in a second meeting. Concentration is determined by the characteristics of the industry;



DISCERNING EVALUATION OF DATA FROM ALL SOURCES IS FUNDAMENTAL TO ACCURACY OF MARKET STUDY.

sampling size depends on the size of the industry and the information wanted.

Now, the heart of the technique is applied, the depth interview at multiple level. Based on a formalized questionnaire, the interrogation develops deeper information than mere "yes" and "no" replies. The questions seek motivations in the buyer to uncover the factors which either make or hinder sales.

If the study involves a new product, samples are left for testing. If it is a piece of industrial equipment, it is sent to independent laboratories for testing and installed in plants for operational runs where possible. Laboratory reports and plant test runs are discussed with the interviewees for their reaction to the product and its performance.

The interviewees are selected from various sources: the present customer list, lost customers, potential customers, and in addition, persons are selected from manufacturing directories, advertising lists, and trade publications. A thorough and com-

prehensive list which adequately pictures the market is preferred to sheer numbers.

While the field men make their rounds gathering direct results, another group culls the secondary data from trade publications, associations, and government statistics.

Not every interviewee will pour out all the details of his motivations. Experience shows two out of four interviewees refuse to divulge any information, four give almost complete interviews, and the remainder are fully cooperative and informative.

In using the depth interview, conversation digresses from the prepared questionnaire. It is then that the interviewer allows the conversation to flow as it will and then directs it back to the proper channels when the extraneous line of thought has been exhausted. Such digressions often reveal avenues worth exploring which may not have been originally contemplated in the design of the questionnaire.

The depth-type interview should be exercised on multiple level. The interviewers' contacts should range from the president of a company down the line through the vice presidents and on to planning, project, maintenance, and industrial engineers. The multiple level approach provides opinion and information from various management strata across the industry and provides balance between the office men, the shop men, the salesmen, the manufacturer, the jobber, the wholesaler, and the retailer.

When the field work is completed, the interview information is collected and combined with that taken from the secondary sources. All of this is sorted, tabulated, correlated, and collated. From the sum of it all are extracted the data sought.

Management, considering a new product, is then in a position to evaluate the feasibility of manufacturing and marketing its latest development. Considering the established product, management becomes aware of the errors to be rectified and the steps which must be taken to regain, hold, and enlarge the product's market.


Alert management has long since learned of the value of the market study—and that when you own a factory, you can manufacture; when you own a market, you can manufacture and sell.

Engineering Wonders

MEMBERS of the American Society of Civil Engineers are now voting to determine the "Engineering Wonders of the United States." The Civils are divided into 74 territorial sections, and each section is picking the most impressive engineering feat in its geographical area. When all returns are in, a final selection of the best will be made to determine the "Seven Engineering Wonders of the U.S." Only nine of the sections have sent in their choice, and with the Civils, bridges are well in the lead.

Cleveland—Terminal Tower Group.
Cincinnati—Suspension Bridge, built in 1866, first link between North and South after Civil War.
Los Angeles—Colorado River Aqueduct.
New York—George Washington Bridge.
St. Louis—Ends Bridge across the Mississippi.
Sacramento—Trans-Sierra run of Central Pacific.
San Francisco—Golden Gate Bridge.
Tocoma—Grand Coulee Dam.
Washington, D. C.—Major L'Enfant's city plan.

Bonding



AFTER DIPPING SANDBLASTED GEAR HUB IN THE ALUMINUM BATH, THE OPERATOR INSPECTS PIECE.

Aluminum to Ferrous Metals

STAFF REPORT

ENGINEERS, working with metal parts, are constantly looking for new ways to combine the most desirable properties of one metal with other equally desirable properties of a second metal. The industrial use of plating is one field in which the bi-metallic article has assumed prominence. A chrome plated table knife has the strength and elasticity of steel with the resistance to corrosion and surface abrasion of chromium. In engineering, the hard chrome plated cast iron piston ring and the steel backed babbit bearing are two everyday examples of bi-metallic applications.

There exists, however, another field of bi-metallics. If the required bulk of metal is so great that plating is not possible, a cladding metal can be bonded to the base metal at some point well back in the manufacturing process. In copper-clad steel wire, the copper is bonded to the steel billet, which is then rolled and eventually drawn into transmission wires. In this application, the tensile strength of the steel core combined with the electrical conductivity of the copper, make for a transmission wire with excellent all-around characteristics.

An important new field for bi-metallics has been opened by the Al-Fin Division of Fairchild Engine and Airplane Corporation — the bonding of aluminum to ferrous metals.

Al-Fin is the trade name of a patented casting process for the molecular bonding of the casting alloys of aluminum to steel, iron, nickel, titanium, and certain other metals. The method was introduced in 1941 and found successful application in the aircraft cylinder barrels with aluminum cooling fins used throughout World War II. By uniting the high heat conductivity of aluminum with the strength and resistance to abrasive wear of an alloy steel, the heat dissipating effectiveness could be increased and the assembly weight decreased, as compared with steel finned cylinders. Of major importance is the fact that the bond prevents separation of the aluminum and steel after periods of operational heat cycling — thus eliminating the air insulating

heat dam and drop in thermal efficiency which results when aluminum fins are pressed, shrunk or merely cast-on to the steel cylinder liner.

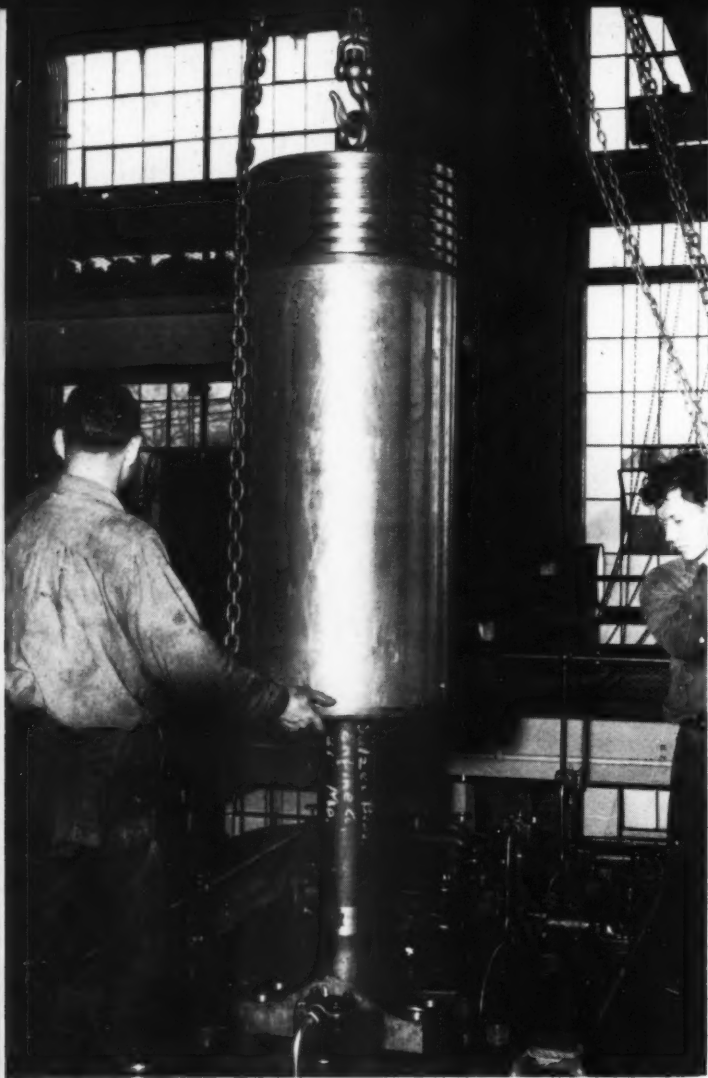
One large manufacturer in the automotive field, who was one of the early licensees under the Al-Fin patents, says that in the five-odd years that the process has been used in their plant there has never been any reason, either from inspection reports or field performance data, to question the strength and quality of the bond. Saving in material, machining time, and a better designed product have justified the initial investment in equipment and other additional costs.

Commenting on manufacturing techniques, this licensee pointed out that for his particular application, namely, that of bonding aluminum-finned cooling mufflers to steel cylinder barrels, certain factors had to be closely controlled to insure a bond of maximum strength and uniformity between the cast aluminum and the ferrous component.

1. They prefer the use of a bonding bath of 99.5 percent commercially pure aluminum. The iron content of the bonding bath increases with its con-



RACING CAR MAGNESIUM BRAKE ASSEMBLY WITH AN ALUMINUM BONDED BI-METALLIC BRAKE DRUM.



LARGE STATIONARY DIESEL USES PISTON OF CAST IRON WITH ALUMINUM BONDED TO TRUNK SURFACE.

tinued use for bonding, since iron is soluble in molten aluminum. If there is an excessive iron content in the aluminum bonding bath, the strength of the bond is impaired. In order to maintain the purity of the bonding bath, it is periodically "sweetened" by the addition of pure aluminum ingot.

2. In order to maintain the desired hardness in the finished steel cylinder wall and yet obtain optimum bond thickness of approximately .001 in., both the bonding time and bonding bath temperature must be controlled. This is accomplished with automatic recording and controlling potentiometers and timing devices. Such control prevents a drop in hardness of more than one or two points in the Rockwell C range, the minimum requirement being 28 Rockwell C hardness.

3. The ferrous components are sandblasted to remove all foreign matter and oxides. It was stated that even a fingermark on the cleaned surface could affect the uniformity of the bond in that area.

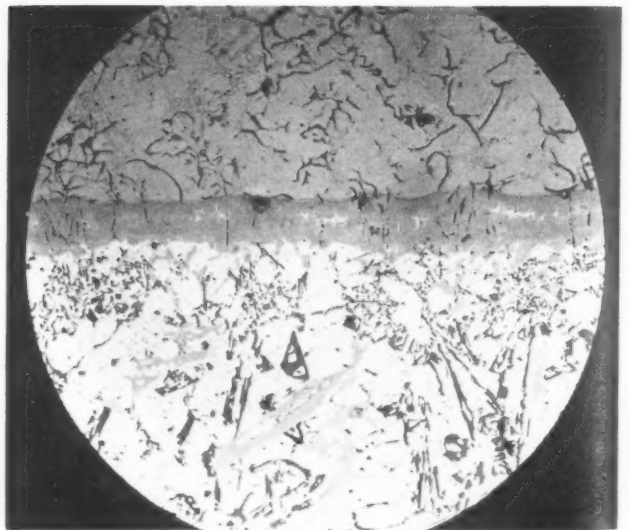
4. To insure a uniform and complete bond around beveled edges and radii, it is necessary that no entrapped air be present in such areas during the bonding operation in the aluminum bath.

These comments summarize the manufacturing experience in one particular application of the process. In other applications of the Al-Fin process there are undoubtedly different problems to be met, depending upon the type of ferrous metal used, volume of metal being bonded, hardness required in the finished ferrous component, complexity of the ferrous components. For example, in the case of ferrous components of complex configurations containing sharp corners, re-entrant angles, or small holes, a bonding bath of greater fluidity is required. Greater fluidity is obtained by additions of silicon or other metals to the bonding bath. These additions have the advantage of inhibiting the rate of bond thickness formation.

Today, the Al-Fin process has 12 licensees in the U.S. and 10 in 5 foreign countries. Fairchild officials estimate a substantial increase in 1953 over the 5 million pounds of aluminum used during 1952 for bond-casting to steel and iron components under their patented process.

The constantly increasing production of bonded bi-metallic products is the outcome of the process research and new application development work carried on in their experimental foundry facilities at Farmingdale, N.Y.

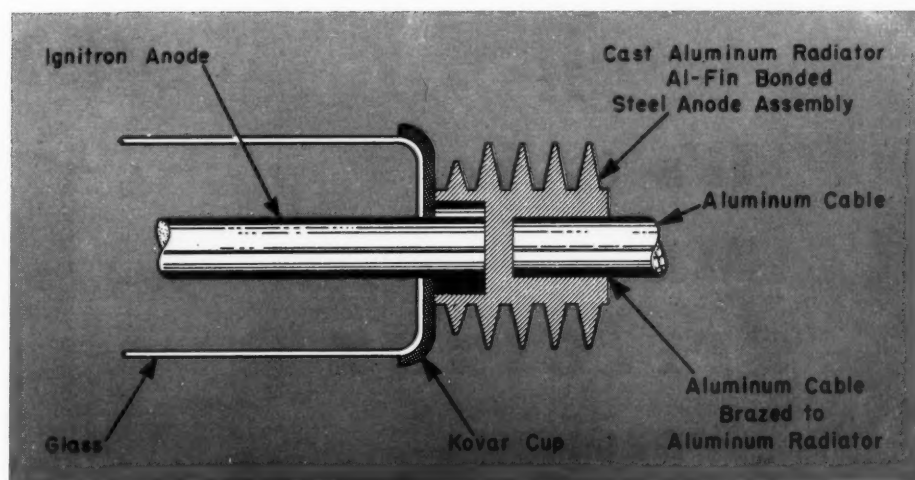
The widest use has been in aluminum pistons



AN ETCHED SPECIMEN SHOWS THE MICRO-STRUCTURE OF THE NI-RESIST CAST IRON (TOP); BOND INTERFACE (MIDDLE); AND ALUMINUM (BOTTOM).

with bonded-in ferrous metal ring carriers. These ring carriers, by reducing top ring groove wear, are giving exceptional service and greatly extending piston life. Some armored ring band pistons have passed the 300,000 mile-mark in engines which formerly required replacement of ordinary alumi-

ALUMINUM CABLE BRAZED TO BONDED-ON ALUMINUM TERMINAL STUD — REPLACES COPPER CONNECTORS IN TYPICAL ELECTRICAL APPLICATION.



num pistons before 75,000 miles of regular service.

Heat transfer applications range from aluminum finned air-cooled cylinder barrels to commercial heat exchangers, with many interesting applications in other fields. Internal cooling fins of aluminum bonded to the rotor of an eddy current clutch are an example.

Steel-backed aluminum cap, slipper, thrust, and sleeve bearings and bushings offer the excellent bearing qualities of aluminum, coupled with the strength, resilience, and fatigue resistance of steel. They are especially suitable for heavy-duty applications, such as are found in diesel engines.

For automotive use, bonded bi-metallic brake drums have the advantage of marked reduction in fading, longer drum and lining life with reduced heat checking or crazing of the drum, and less frequent lining replacement.

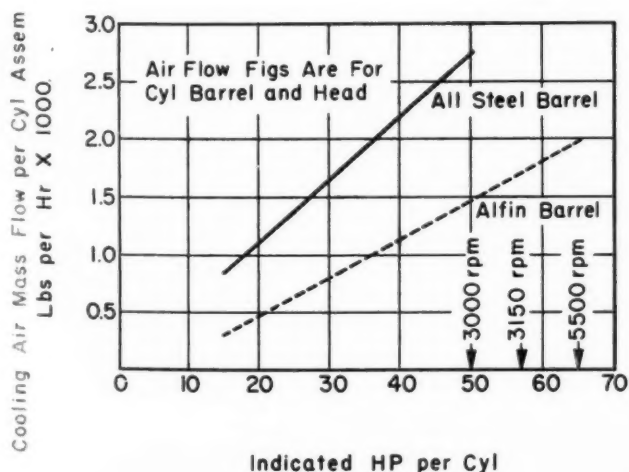
The ability to provide oxidation protection for the ordinary steels or irons at elevated temperatures and in the presence of corrosive gases, permit savings in critical metals by the use of carbon or low

alloy steels for a great number of applications without any reduction in life or strength qualities. Aluminum bonded coatings are particularly well-suited for such parts as gas turbine combustion chambers and tail pipes. They have also proved outstanding when exposed to high concentrations of sulfur or sulfur compound gases at elevated temperature conditions.

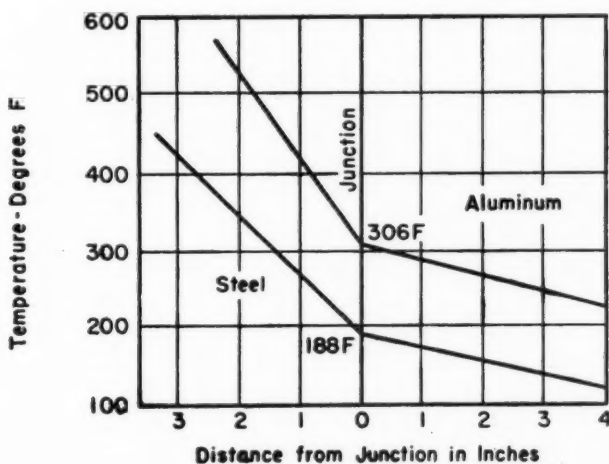
Aluminum housings with bonded-in preformed steel tubes to direct the flow of fluids offer many interesting possibilities in the fields of Commercial and Aircraft Hydraulics and Pneumatics. The bond prevents leakage between the aluminum and the steel tubes even at high temperatures and pressures. Since the tubes can be formed to the desired curvature, greater operating and manufacturing efficiencies are possible than can be obtained with "drilled and plugged" hole systems.

In like manner, bonded aluminum-steel tube connectors make it possible to hermetically seal alu-

(Continued on page 62)



A STEEL CYLINDER BARREL REQUIRES MORE COOLING AIR FLOW THAN ALUMINUM BONDED BARREL.

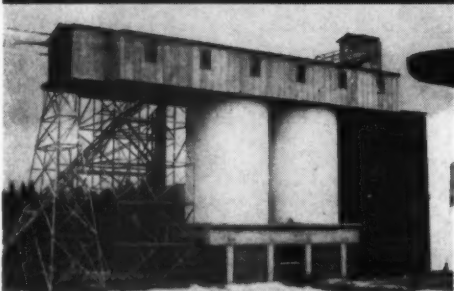


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PRECAST CONCRETE PRODUCTS FOR FARM, HOME AND INDUSTRY

Many Cities Act On Off-Street Parking Projects

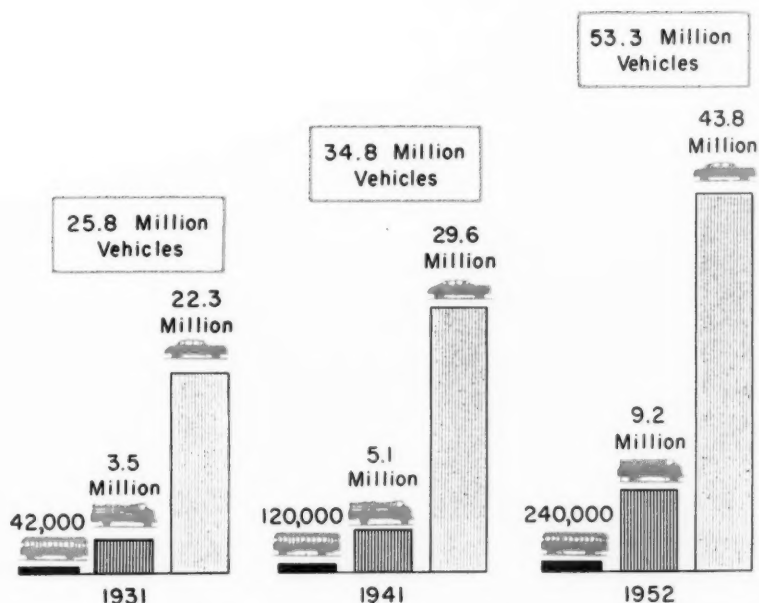
AS A RESULT of the increasing number of automobiles being driven in the United States, as demonstrated by motor vehicle registrations which have more than doubled in the past 21 years, many cities are faced with the problem of providing additional off-street parking. Plans for the financing and construction of additional parking facilities are continuing to receive widespread attention in cities of all sizes throughout various states.

California—Plans announced in San Francisco call for municipal acquisition of a site on which private enterprise would erect a six-story, 900-car garage building. Estimated cost of the structure is between \$1,750,000 and \$2,250,000.

Colorado—Denver officials recently reported that an off-street parking structure will be built on five lots purchased by the city for \$165,000. Type of building has not been decided upon. Meanwhile, Denver opened its first city-owned parking lot built under a \$4 million off-street parking bond issue. The bond issue also is being used to finance the city's other parking projects, including two elevator-type parking buildings now under construction at a total cost of \$1,430,615. Both structures are scheduled for completion late this year.

Delaware—The city council of Wilmington has adopted an ordinance authorizing issuance of \$925,000 in general obligation bonds to finance acquisition of a site for the Wilmington Parking Authority's first off-street parking project. The bonds will not be sold until later this fall. Meanwhile, the city is arranging to lend the \$925,000 to the Authority for purchase of the site. After this first purchase of the property, the Authority will issue its own revenue bonds in the amount of \$3,500,000 for acquisition of additional property at the site and for construction of a three-story parking facility.

Florida—A State Supreme Court opinion upholding the validity of Jacksonville's \$3,265,000 parking revenue bond issue, cleared the way for the city to proceed with its financing of off-street parking facilities. Meanwhile, a special committee has been studying the possibility of constructing



GROWTH OF MOTOR VEHICLE REGISTRATIONS.

an underground parking space in Jacksonville.

Illinois—Construction has been started by Chicago on parking garages and lots in two outlying business centers and in the downtown area. To finance the program, a \$22,600,000 issue of revenue bonds was sold early this year, and bonds for \$28 million more are authorized. The Chicago program, as thus far projected, includes plans for five parking garages in the loop and four on the north side to accommodate a total of 6169 automobiles. Thousands more vehicles will be accommodated at seven sites on the south side, all to be parking lots. One of the projects now under construction is a garage to accommodate 2359 cars being built under Grant Park. (See "Chicago's Solution to the Parking Problem," CE, March, 1953).

Under a privately-financed off-street parking program in the city of Springfield, which has attracted nationwide attention since its launching last year, two major parking lots have been opened in the first of a series of such facilities planned by Springfield Downtown Parking, Inc.

Maryland—Seventeen parking garages, with a total capacity of 3473 cars, and costing \$5,714,000, have been completed under the Baltimore Off-Street Parking Commission's program. Two additional structures, with spaces for 591 cars, are under construction at a cost of \$1,347,745. The Commission,

which was created in 1949, is authorized to lend private companies up to 85 percent of the money needed to build multi-storied parking structures.

Although the Commission requires that individual sponsors provide a minimum of 15 percent of the over-all cost of each project, the sponsors of nine approved projects to date have provided 18.6 percent of the total cost, bringing their total investments to approximately \$1,313,000. The sponsor's contribution, under the program, may be the site of the garage.

The city authorized two bond issues of \$5 million each to finance construction of the parking facilities. Out of the first authorization, a total of \$4,103,200 in bonds has been issued, of which \$3,801,600 are still outstanding. Of the second \$5 million, only \$32,100 in bonds have been issued. This leaves a total of \$6,166,300 of borrowing capacity currently available for the loan fund. So far the bonds have not been offered publicly, but have been bought for the city out of sinking funds, or for the account of the municipal pension system.

Michigan—Formation of a municipal authority to initiate parking relief measures has been recommended to the Lansing City Council by a committee appointed to study both the city's problem, and action being taken elsewhere. The committee reported that its studies of both large and small cities in Michigan and several other states revealed that "every successful operation was the result of the establishment of a parking authority." The advantages of a parking authority are many and varied. With flexible powers granted, it can plan and pursue the most advantageous course in providing municipal parking, whether it be through leasing particularly suitable sites, outright purchase of locations, or cooperative action with existing parking concerns and merchants groups."

Nevada—Final arrangements are being made for acquisition, by the city of Reno, for a \$218,000 site on which a private joint venture group plans to build and operate an \$800,000 parking facility. The lessees, who will build and operate the parking structure under a 39-year lease, include the W. and B. Co. and Haas and Haynie Co. of California, and Wells Cargo, Inc., of Reno.

New Jersey—A resolution adopted by the Delaware River Port Authority directed its transportation committee to investigate the economic feasibility of erecting a 500-car garage near one of the Camden stations of the Delaware River Bridge high-speed line. Under terms of the interstate compact which created the Authority, the parking facility cannot be constructed until the bi-state agency has submitted a detailed report on the proposals and explained why private enterprise either will not or is incapable of undertaking the project. Official ap-

proval must be given by both the New Jersey and Pennsylvania legislatures.

New York—In preparation for its entry into the metered parking lot business, New York City recently broke ground for the development of a projected 780-car facility at Flushing, Queens. Four other tracts near express subway or elevated stations in the Bronx, Brooklyn, and Queens, also are under consideration as sites for additional metered lots.

Ohio—Columbus city officials are continuing to work on plans for both parking garages and municipal parking lots. First major project is expected to be a \$1,425,000 garage.

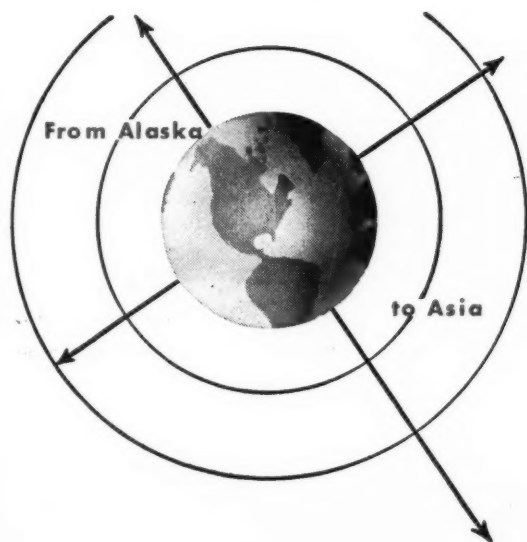
Cincinnati has plans for an \$8 million program for garages and lots at eight downtown sites. An underground project also has been proposed.

Pennsylvania—Two multi-level parking garages, one with a capacity of 465 cars and the other 496 cars, are now being constructed by the Philadelphia Parking Authority, with completion scheduled around the end of this year. The projects are being financed by revenue bonds, of which the Authority now has \$4,650,000 outstanding.

Tennessee—Although the city of Memphis has sold \$1,100,000 in bonds for construction of a 500-car parking garage at Monroe and Front Sts., it is now doubtful as to whether the project will be undertaken. Memphis city officials say they are trying to work out a deal with a private firm for construction of a 1000-car garage in Court Square under a plan by which the builder and operator would pay the construction costs. It was indicated that if this arrangement is worked out, the plans for the Front and Monroe St. structure would be dropped. The Court Square building would cost an estimated \$2 million.

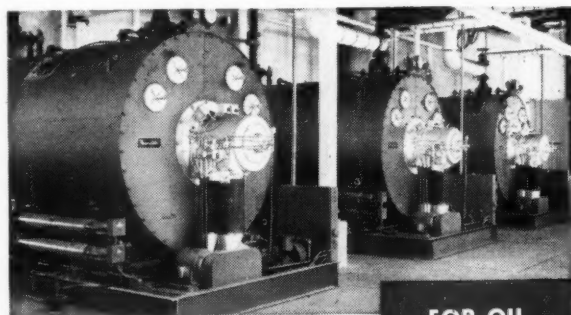
Wisconsin—Clearing the way for further progress of off-street parking plans in Milwaukee, the Wisconsin legislature enacted two bills designed to facilitate financing and construction of such projects. One of the measures will permit Milwaukee to issue revenue bonds for the construction of parking structures as well as parking lots, and to retire such bonds with parking meter and other parking revenues, as well as with revenue derived from the specific facility built through sale of the bonds. The other new act permits cities and villages to acquire land for parking structures that would contain space leased for stores and other purposes of benefit to the public in its use of the parking facility.

Other Milwaukee parking developments include a recent report, made by a city study committee, which recommended creation of a 1300-car fringe parking station on the lake front.

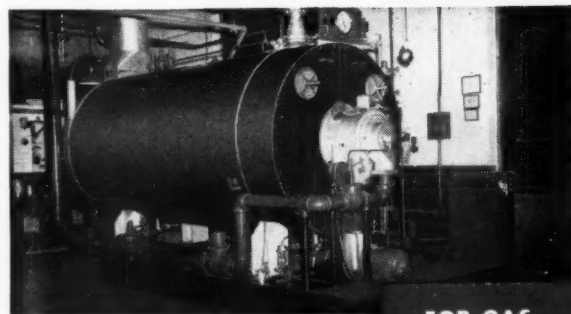


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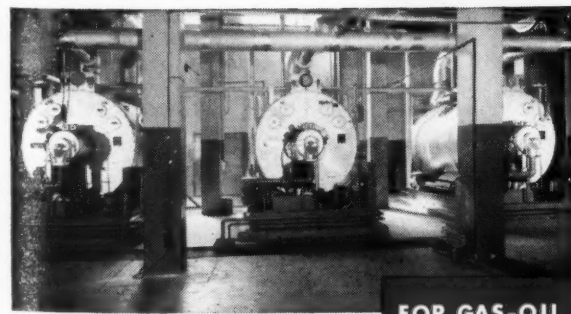
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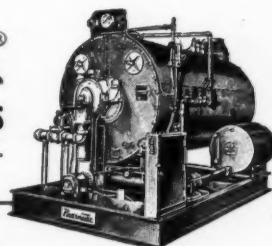
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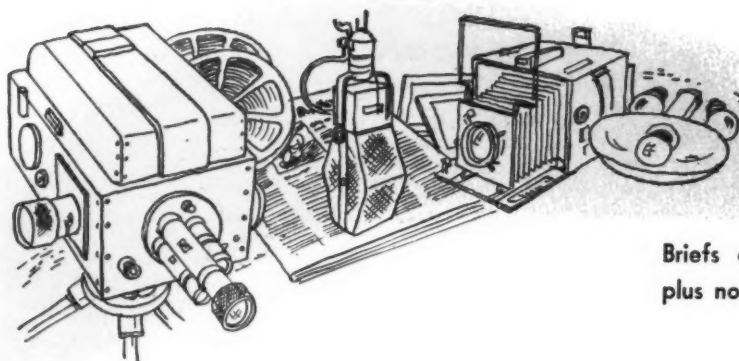


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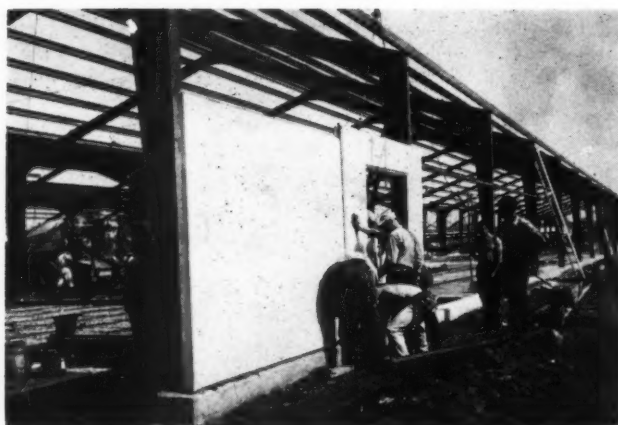


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NEWS

Briefs of current interest to the consulting profession plus notes on new equipment in the field of engineering



Building Erected in Five Days With Precast Concrete Panels

Use of insulated, precast concrete wall panels, manufactured and erected by The Marietta Concrete Corp., permitted the walls of the new Ohio State Fairgrounds merchants and manufacturers exhibition building to be erected at the rate of 4200 sq ft per day. Some 204 of these panels were used to close in this 500 x 150 ft building in less than 5 days. Two basic sizes, measuring 8 x 10 ft and 8 x 8 ft, were used. Each panel is 5 in. thick, and consists of two layers of high strength concrete separated by 2 in. of rigid Owens-Corning Fiberglas insulation.

A motorized crane was used to lift the panels off trucks and to swing them into position against a standard Butler steel framework. When in position, the panels were bolted directly to the framing. Aluminum windows will be fitted into the steel window frames cast into the panels. The roof was built up of blankets of special Owens-Corning Fiberglas Aerocor insulation draped over the purlins and covered by aluminum roofing planks. The contractor was George Sheaf & Co.

Certification Planned for Sanitary Engineers

Certification of sanitary engineers has been recommended by the Joint Committee for Advancement of Sanitary Engineering, a grouping of representatives of five major organizations in the field:

American Public Health Association, the American Society of Civil Engineers, the American Society for Engineering Education, the American Water Works Association, and the Federation of Sewage and Industrial Wastes Association. As proposed, a Specialty Board of five members, as recommended by the joint committee, will be appointed by the Board of Direction of ASCE. Functions of the board members will be augmented by appointed consultants. Ultimately, both the joint committee and the specialty board are proposed to become administrative functions of Engineers Joint Council.

Upon application by individuals and satisfactory evidence of professional ability in the field, certificates of membership in the American Academy of Sanitary Engineers will be issued. The sole purpose proposed for the academy is recognition of those certified by the specialty board. Before this proposal can become a reality, endorsement of the ASCE Sanitary Engineering Division and approval by the ASCE Board of Direction are needed.

As a definition of sanitary engineering, the joint committee adopted the statement prepared by the Committee on Sanitary Engineering of the National Research Committee in October, 1943.



Wrought Iron Pipe Used For Sewage Disposal Plant

Cleaner streams and improved public health conditions are expected to accrue to the city of Cincinnati as a result of its \$8½ million investment in new

(Continued on page 56)

BOILERS

10 STORIES HIGH!

Three new B-I-G boilers on the West Coast will have all of the cost-saving advantages of B-L tube-supported wall enclosures and Texad* finishes. The order for one of them—a 1,250,000-pound-per-hour unit—has just been placed. Construction on the others—850,000-pound-per-hour boilers is now being started.

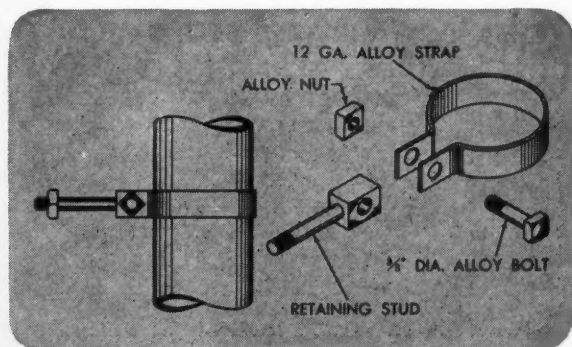
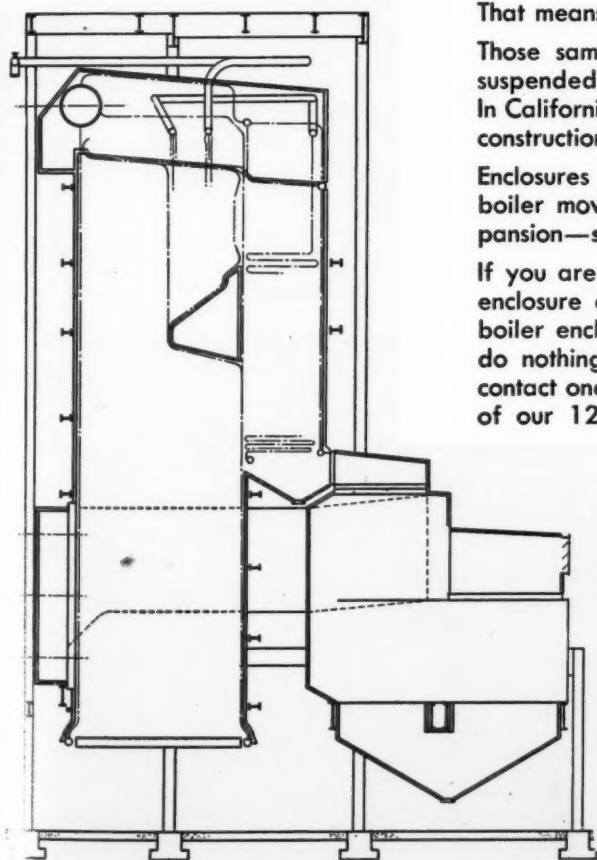
That means they'll cost less, save steel, operate more efficiently.

Those same advantages can be earned by specifying Bigelow-Liptak suspended settings for any large size industrial or public utility boiler. In California, for example, the king-sized, 10-story boilers will have lower construction and material costs and will not need tough-to-get steel plate.

Enclosures will be tighter, too. Tube-supported walls breathe with the boiler movements and TEXAD* flexes itself right along with boiler expansion—something that a steel plate casing that large could never do.

If you are building a large boiler, or a small one, insist on a separate enclosure quotation. You'll save plenty and you'll get a specially-made boiler enclosure engineered for your particular furnace by people who do nothing else but build furnace enclosures. Write Detroit today, or contact one of our conveniently-located offices. Be sure to ask for a copy of our 12-page tube-supported wall catalog—and a TEXAD* folder.

*T. M. REG.



One method B-L uses to fasten the enclosure to the tubes without welding into the tube. Tile-supporting castings are hung on the studs.

3133

BIGELOW-LIPTAK Corporation

and Bigelow-Liptak Export Corporation
2550 W. GRAND BLVD. • DETROIT 8, MICHIGAN

UNIT-SUSPENDED WALLS AND ARCHES

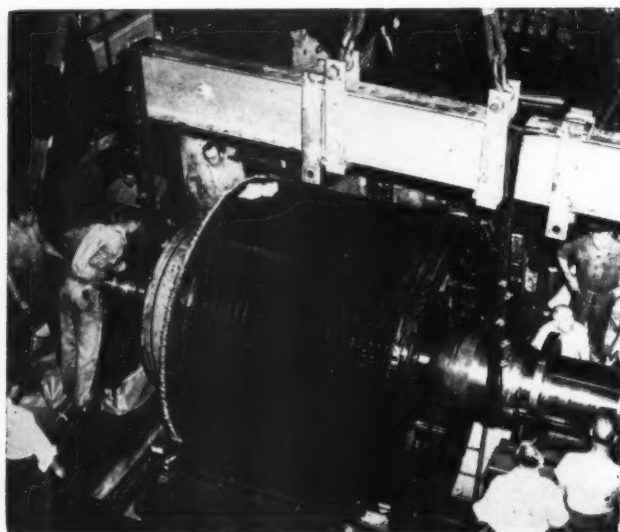
In Canada: Bigelow-Liptak of Canada, Ltd., Toronto, Ontario

ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DENVER • HOUSTON • KANSAS CITY, MO. • LOS ANGELES • MINNEAPOLIS • NEW YORK
PITTSBURGH • PORTLAND, ORE. • ST. LOUIS • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SAULT STE. MARIE, MICH. • SEATTLE • TULSA • VANCOUVER, B.C.

Iron Pipe Used for Sewage Plant

—Starts on page 54

sewage disposal facilities, according to A. M. Byers, manufacturers of wrought iron products. Engineers Havens & Emerson, Cleveland, specified approximately 57 tons of corrosion-resistant wrought iron pipe in railings; downspouts; cold water lines, size 1 and 2 in. dia; and all underground heating lines, as well as for the 12 in. well casing, and the hot and cold water lines in the chlorination system. L. E. Stevens is the plumbing and heating contractor.



Electrical Equipment Overhauled in Record Time

By mobilizing a team of 133 engineers and technicians from throughout the East and Midwest, General Electric's Apparatus Service Shops Dept. recently completed a job in nine days that would normally require a month. The work, which entailed overhauling and rebuilding of major electrical equipment in the Trenton and Detroit, Mich. plants of McLouth Steel Co., was carried on around the clock, using two 12-hr shifts. This accelerated schedule was decided upon in order to complete the work during normal vacation shutdown.

Cities represented by members of the team included Schenectady, Detroit, Baltimore, Philadelphia, New York, Buffalo, Pittsburgh, Boston, Chicago, Milwaukee, Richmond, Johnstown, Pa., and Charleston, W. Va.

The primary task was the reconditioning of the blooming mill drive at the Trenton plant. It involved a main motor generator set with a 7400 hp synchronous motor; three 1750 kw generators; two 3000 hp motors, plus cleaning and reconditioning all auxiliary motors and generators and a modification of some control panels.

Special tools and jigs were made on the job; others were brought in from G-E's service shop at Pittsburgh. Brazing equipment was shipped from Schenectady. During the job, one of the brazing trans-

formers had to be replaced and a unit was flown in from the factory in a matter of hours. A special binding band was made up in one day at Schenectady, and brought to the job by the manager of manufacturing, Large Motor and Generator Dept.

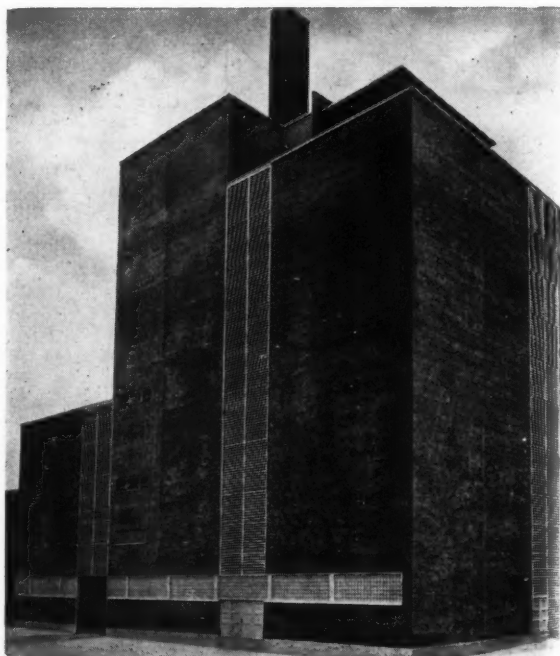
With only one single-hook crane available, rigging and moving had to be scheduled for maximum utilization. Typical of the rigging problems was handling of the rotor in the photograph, weighing 50 tons. The rotor was overhauled and put back in place with a clearance of 0.003 in.

Package Laboratory Built For South American Mine

An entire laboratory designed to operate for six months without additional supplies has recently been completed by Sam Tour & Co., research and testing consultants. For use by the Orinoco Mining Co. in Cerro Bolivar, Venezuela, it is located in the interior, 55 miles south of the Orinoco River.

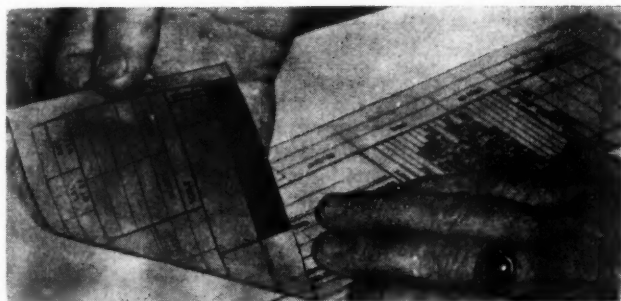
Since the mine is too remote to receive frequent delivery of supplies, everything necessary for operation from personnel to pipettes is included. To facilitate handling of more than 200 samples which will be analyzed daily during two 8 hr shifts, new methods of analysis, tabulation, and labeling were developed. In some cases, the revised methods cut analytical time in half.

(Continued on page 59)



LOUVERS USED AS ARCHITECTURAL PATTERN

Three continuous vertical banks of louvers, 13 ft wide, and 91, 76, and 41 ft high, comprise the walls of the steam recovery building of Crossett Paper Mills. Designed by Rust Engineering Co., the louvers were fabricated in all-aluminum construction with 0.081 in. thick aluminum blades and 0.051 in. thick jambs, using 3S-H14 aluminum. Pivots are 1/2 in. dia stainless steel with Oiltite bearings.



Printed Plastic Sheets Shorten Drafting Time

Thin, transparent, printed plastic sheets which can be applied to paper, vellum, or cloth without the use of heat, have been developed by Johnson Research Corp. to eliminate time-consuming hand lettering, symbol drawing, and ruling required for engineering drawings.

Known as Transeals, the sheets are coated with a pressure-sensitive adhesive protected by a removable waxed paper sheet. They can be furnished for application to either the reverse side or the face of drawings. Type, rule lines, and symbols can be prepared to meet individual specifications.

AEC Contracts for Study Of Single Purpose Reactors

Another step on the road to peacetime utilization of atomic power has been taken by the Atomic Energy Commission. In its latest contract calling for design studies by private industry, the AEC has commissioned Walter Kidde Nuclear Laboratories, Inc. to make a study of "a nuclear power plant for use in an isolated high-cost power area."

The study will concentrate on a "single purpose" reactor of 30,000 kw capacity. This type of unit is generally defined as a reactor designed specifically for a single purpose—in this case, the production of power. In comparison, "dual purpose" reactors, which have recently been widely publicized as a result of a number of surveys made by private industrial concerns, provide for the production of plutonium and power as co-products. It is proposed that the plutonium would then be sold to the government for use in the weapons program.

An "isolated high-cost power area" is defined as a place where electrical power is not readily accessible at usual costs. Examples include uninhabited desert areas where power may be needed for industrial development, and off-shore locations where conventional fuels will not permit economical power generation.

The contract between AEC and Walter Kidde calls for a detailed cost analysis to cover architect-

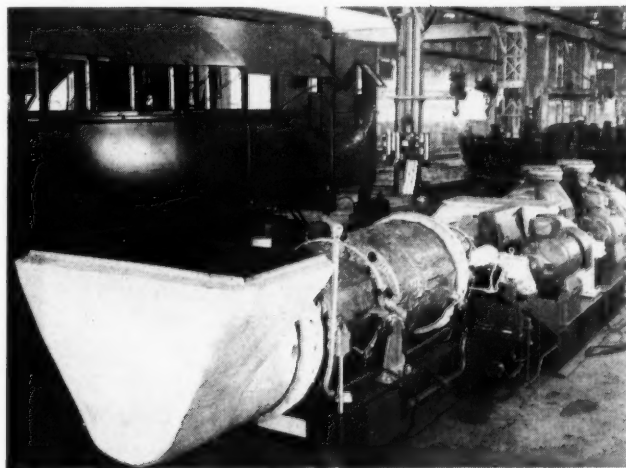
engineer costs, construction costs, and operating costs for a four-year period following start-up of the plant. Also to be carried out under the contract is a study of the effects of site location upon reactor design and power cost. Completion of the study is scheduled for late 1953.

Safety of Sealed Dry Type Transformers Proved

Sealed dry type transformers, even under the most hazardous conditions, present practically no danger of fire, according to E. W. Tipton of Westinghouse Electric Corp. In a report to engineers attending the Summer General Meeting of the American Institute of Electrical Engineers, Tipton told of extensive tests conducted "to determine to what extent gross mistreatment of sealed dry type transformers with Class H insulation might be expected to involve fire or explosion hazards."

Until a few years ago, almost all transformers for ratings of more than a fraction of one kva were immersed in mineral oil and were located out of doors. Development of the dry type using inorganic material almost entirely has changed the picture, however, and now permits use of transformers in restricted and hazardous locations. Only in the absence of overload protection of any kind, with continued operation at high overloads, is it possible to ignite and burn the small amount of organic bonding material used in the dry type, he said, and even then the fires are of low intensity and easily extinguished.

"Millions of kva of installed capacity in transformers of this type are in operation with, so far as known, a perfect record in regard to human safety."



PORTABLE COMPRESSOR DRIVEN BY GAS TURBINE

This 1800 hp gas turbine-compressor has since been installed in the trailer shown in the background, and is now undergoing tests. The plant consists of a 8750 rpm Westinghouse gas turbine, two Clark Brothers multi-stage centrifugal air compressors, a 50 hp starting motor, and a 60 kw generator and auxiliaries. In addition to distillate fuel, the plant requires electrical power for starting. Once in operation, the generator supplies required electricity for auxiliary motors.



Independent Laboratory

—Starts on page 28

suggest a working arrangement to take maximum advantage of the sponsoring firm's scientific staff and its previous experience with similar problems. The objective of the proposal is not to construct a rigid formula which must be adhered to throughout the program, but rather to provide a flexible and efficient guide to bring the project to the most rapid and successful conclusion possible.

Financial Aspects

One of the pertinent questions that always arises in planning a research program is "How much will it cost?" Because this question can usually be answered only in broad terms, and because the research process is a long and complex one, it is important for the client to specify at the outset his financial capacities and limitations. If a relatively small amount of money is available, the laboratory will pick out those phases of the project which must be accomplished first, so that, in the event of an interruption, the program can be continued at some future time without undue loss of motion.

It has been estimated that among research projects undertaken to develop a new product or process, only one project in 10 has a financially successful result. Therefore, the chances for success are more favorable if a sufficient number of related projects are undertaken to assure a reasonable coverage of various aspects of the problem and satisfactory progress.

Probably the most effective organization evolved for working on a research program is by "planned assignment." Under this procedure several people of varying technical and scientific skills are assigned to the project on a stand-by basis. The senior scientist or project engineer devotes himself exclusively to the theoretical planning and supervisory phases of the program, while delegating the mechanics of carrying out the investigations to technicians.

The hourly charges for time, which is the only basis on which a consulting research firm usually works, range from \$5 to \$20 an hour, depending on the technical level of the personnel concerned. Under the planned division of labor, experience has shown that the average project costs about \$8 per man-hour to maintain. Calculated on a yearly basis, a program operated under this arrangement will cost about \$16,000 per man-year. These costs are cited to indicate the range within which the average project can be expected to fall. Supplies and equipment bought specially for the project are regarded as extraordinary costs and are passed along on a separate ex-

pense voucher for the client's approval and payment.

When a project is received by the laboratory, the technical director assigns it to a project leader. The project leader studies the project and devises a tentative program. This program is then discussed with senior scientists in the departments whose services will be involved, and finally, with the technical director who in turn approves it.

Effective Administration

The project leader is responsible for assigning various phases of the work to the laboratories involved. He must schedule the work and must maintain general supervision, keeping fully informed on its progress. He continually evaluates the information obtained in terms of the sponsor's problems and sees that expenditures are kept to a minimum and within any specified figure.

The independent laboratory will supply regular (usually monthly) progress reports to inform the sponsoring firm of what work has been undertaken during the period and what results were obtained. In addition, a research firm will usually give additional special oral or written reports whenever it obtains positive or negative results of such importance that they will affect the plans for the remainder of the program. Whenever decisions are made to alter the original plan of attack or to abandon it for some more promising approach, the decisions and the detailed reasons are recorded for future reference.

Contractual Agreements

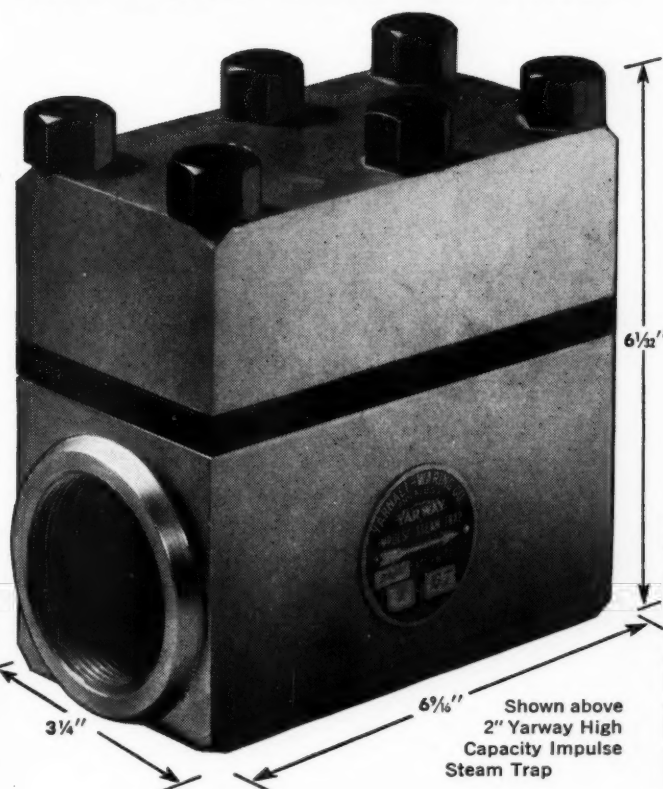
Before the commercial laboratory begins work on a major project, it is customary for both parties to sign a retainer agreement which sets forth their legal rights and obligations. The major features of a typical agreement include the following points:

(1) The research group agrees not to undertake research projects for the client's competitors during the term of the agreement. The client may additionally draw up a supplementary contract to prevent the group from undertaking research for the client's competitors for any subsequent period desired.

(2) Ownership of any inventions or discoveries made by the research group during the research project is usually assigned under the following arrangements: (a) developments directly applicable to the sponsor's field are owned by the sponsor; (b) developments applicable to both the sponsor's field and other fields are retained by the research firm, but the sponsor receives a non-cancellable, royalty-free license to use the development exclusively in his field; (c) developments not applicable to the sponsor's field are retained by the research firm.

(3) Details are given about the facilities to be assigned to the project. They specify personnel, guaranteed monthly working time and laboratory facilities, as well as charges, method of payment, and all other points relating to the services to be provided.

NEW HIGH CAPACITY IMPULSE STEAM TRAP



CAPACITIES OF
YARWAY SERIES 50 TRAPS

Pressure PSIG	CAPACITY* pounds per hour		
	1 1/2"	2"	2 1/2"
1	3000	4670	9500
2	4500	7000	15000
3	6000	9350	19500
4	7000	10900	22400
5	7500	11700	24400
6	8000	12500	26000
7	8300	12900	27300
8	8600	13400	28400
9	8800	13700	29400
10	9000	14000	30250
15	9650	15050	32800
20	10300	16100	35000
40	12530	19600	43500
60	14400	22500	49600
80	16000	25000	55000
100	17300	27000	60000
125	18700	29200	65700
150	19900	31100	70300
200	21900	34200	77400
250**	23500	36200	81500
300**	24700	37400	84000

*Capacities are based on condensate 30° F. below steam temperature.

**When total equivalent length of piping connected to trap is greater than 20 feet, it is recommended that the capacity values indicated for 200 # pressure be used in figuring requirements for all pressures above 200 psi.

Need to handle condensate in unusually large quantities?

Then here is your steam trap—the Yarway Series 50 Impulse—"big brother" to the well-known Series 60 and 120 Yarway Impulse Steam Traps of which over 900,000 have been sold. Uses the same basic operating principle.

The new Series 50 (made in three sizes, 1 1/2", 2" and 2 1/2"), has proved highly successful for condensate drainage on heat exchangers and stage heaters in power plants; re-boilers, reheaters, stills, evaporators, debutanizers, etc., in refineries and chemical plants; large dryers in paper mills and textile plants, etc.

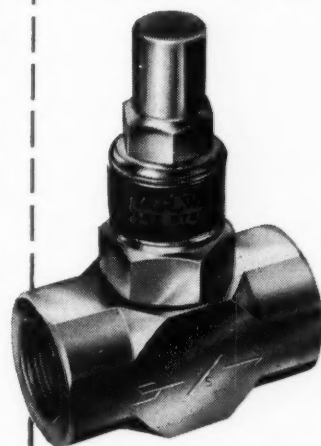
In many cases, Yarway Series 50 Traps have replaced traps several times their size.

For full information, write for Yarway Bulletin T-1745.

YARNALL-WARING COMPANY
106 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY
IMPULSE
STEAM TRAP

OVER 900,000
STANDARD
YARWAY
IMPULSE
STEAM TRAPS
ALREADY SOLD



Series 60 and 120 Yarway Impulse Steam Traps in six sizes from 1/2" to 2" are used for all normal requirements. Stocked and sold by 250 local distributors. See Bulletin T-1740.



Garbage Disposal

—Starts on page 20

state laws, packaged, and widely distributed as animal feed to farmers and hog growers.

Based on design criteria that 0.5 pounds of garbage is produced per person per day in an average city, with a slightly higher figure of 0.69 pounds for public establishments, Hapman-Dutton designed a continuous process cooking installation that would handle four tons of garbage per hour.

Garbage is delivered to the plant site in trucks and dumped on a concrete receiving floor. A radiant heating system in the floor immediately starts to dry the garbage. If the edible and non-edible wastes are mixed together, it is first necessary to sort the garbage. The non-edibles are placed in a small refuse conveyor and carried outside the building where the metal refuse (tin cans) is collected and sold for scrap. The rest of the garbage is pushed into a grille in the center of the floor.

After the garbage is ground it drops to a continu-

ous conveyor. A 70 hp boiler supplies steam to cook the garbage and a thermostatic control regulates the speed of the conveyor to maintain the proper cooking temperature. On the average, the conveyor moves at a speed of about one foot per minute, allowing the temperature to stay above 212 F and providing a cooking period of not less than 30 minutes. At the end of the conveyor, the garbage is carried away as tankage or cooked garbage to be fed to swine or other animals. If desirable, the garbage can be completely dried and packaged in paper bags for shipment simply by adding to the length of the conveyor within the steam chamber and by adding the necessary packaging equipment.

The Hapman-Dutton system of garbage cooking is new. It is being developed as a direct result of the recent legislation forbidding the feeding of raw garbage to animals. While the method seems to offer many advantages, its greatest handicap is that it has not as yet been commercially tried and proven.

It is understood that this company is negotiating a contract with the city of Terre Haute, Indiana to install their garbage cooking equipment. It will be interesting to watch the outcome of this and other new installations as a clue to future possibilities for better and more efficient garbage disposal methods.



Aluminum Bonding

—Starts on page 46

minum tubing to ferrous or copper components of refrigeration circuits.

For Rootes type blowers, cast aluminum alloy lobes are bonded to steel shafts, eliminating the costly lobe shaft coupling problem. Aluminum lobes reduce supercharger weight and extend life because of the reduced inertia and vibratory loadings on gears and bearings. Easily cast and machined to tolerance, it offers many production savings.

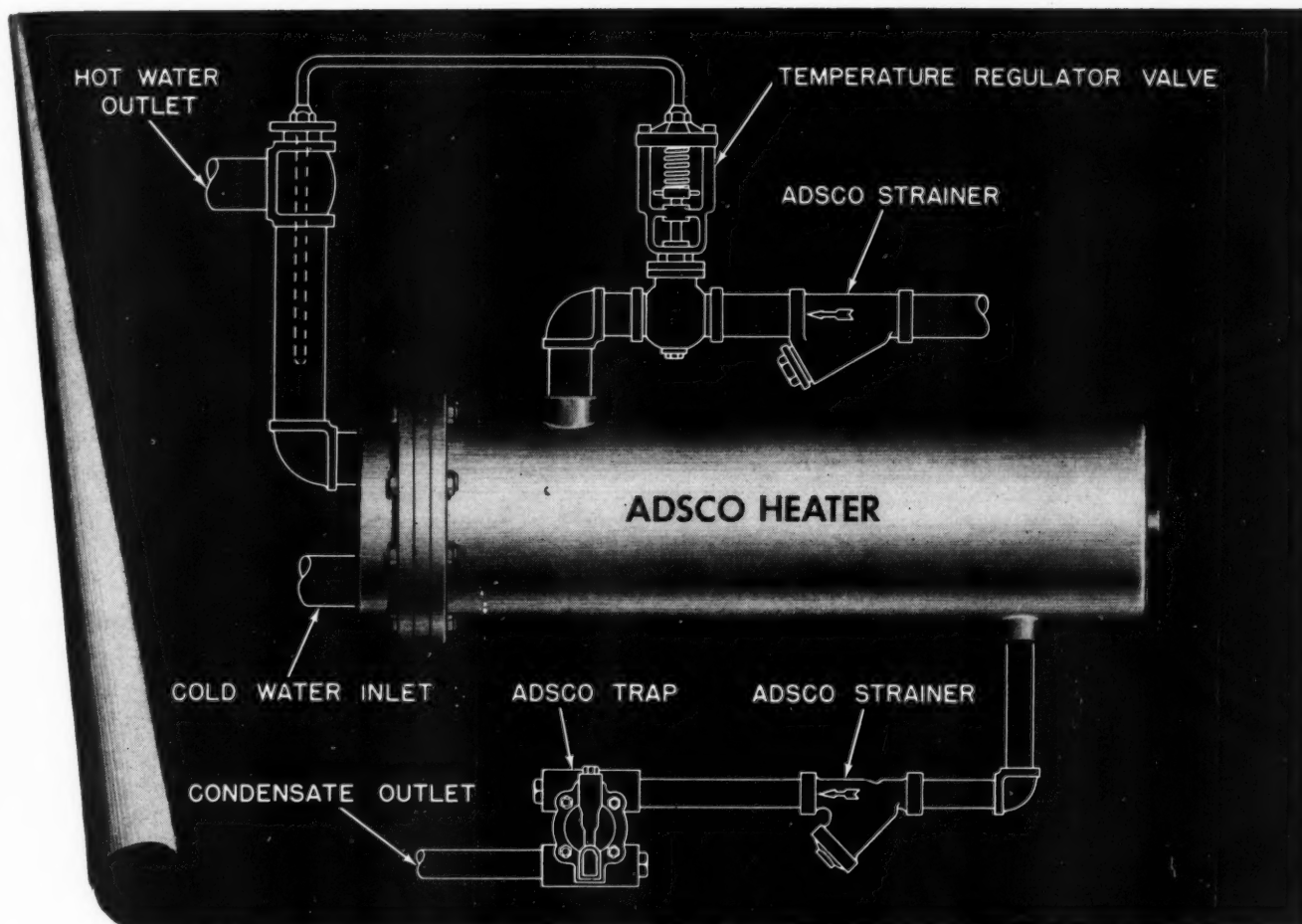
The molecular bond is essentially a complex intermetallic compound of the ferrous metal and the aluminum. It has a mean tensile strength of 15,000 psi and can withstand shearing stresses of the order of 8,000 psi. The bond retains its strength at elevated temperatures of the order of 500 F. There is no measurable drop in temperature across the interface. It is both vibration-proof and leak-proof to hot oil and gases under high pressures. The bond has been tested for oil-tightness up to 3,500 psi of hydraulic fluid, and pressure-tested at 1,000 psi of dry nitrogen and proved satisfactory.

Despite the inherent difference in expansion co-

efficients of aluminum and ferrous alloys, separation of the two metals is prevented by the strength of the intermetallic bond. Physical characteristics of the aluminum can be improved by usual age hardening heat treatment of the bonded parts.

The technique of the process lends itself readily to general foundry practice and the various casting methods, such as sand, permanent mold, plaster mold, and pressure die-casting among others used. Briefly these consist of casting molten aluminum alloy against an especially prepared surface of the ferrous member. No special surface condition of the ferrous component is required. If machined, a standard surface of 100-150 micro-inches is satisfactory. Oxides and foreign matter are removed from the surfaces of the iron or steel parts to be bonded by sandblasting or chemical cleaning. A suitable stop off, generally colloidal graphite, is applied to areas to which the aluminum is not to be bonded.

Only one additional operation and no special equipment or material is required beyond that of a well-equipped aluminum foundry. Therefore, the cost of using the process in production normally does not exceed by 10 per cent the cost of an ordinary aluminum casting of the same size and complexity. The increase in the cost due to the bonding operation is often offset partially or entirely by the fact that keyed, serrated or knurled ferrous inserts are not necessary to obtain an inseparable or leak-proof joint with the bonded design.



BLUEPRINT FOR ACTION!

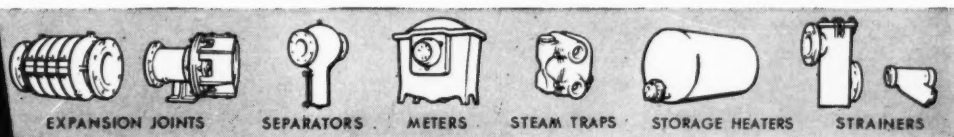
And what action, when you use an ADSCO Water Heater! Hot water . . . when and where you want it . . . and at low cost! ADSCO Instantaneous Heaters furnish industry with general service hot water, boiler feed water, and process water. They supply hotels, apartments, office buildings, dormitories, hospitals, and institutions with hot water for showers, washrooms, dishwashers, laundries, and for general cleaning. ADSCO Convertors, a type of instantaneous heater with a shorter temperature range, furnish *all types* of buildings with hot water for quiet, trouble-free space heating systems.

Yes, you get plenty of action—fast action—out of ADSCO Water Heaters. They operate best when connected according to the typical piping arrangement shown above, with two ADSCO Y-type Strainers to protect valuable equipment and an ADSCO

Dual Steam Trap to handle condensate efficiently.

ADSCO Water Heaters have only three parts: shell, tube bundle, and cover. All are made to ADSCO's high standards. Steel shells are seamless steel pipe, carefully cut and welded by skilled workmen. The shell flange is sturdy and accurately machined and all openings are precisely located. The tube bundles are made of pure, deoxidized seamless copper tubes formed into U-bends. By means of electrically and automatically controlled equipment, they are rolled and expanded into carefully drilled tube sheets which have a diamond pitch arrangement for spacing of tubes. The semi-steel covers are high-tensile, fine-grain castings.

For further information, write for Bulletin 35-78 on Instantaneous Heaters or Bulletin 35-77 on Convertors.



AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877



Shawnee Station

—Starts on page 24

ment. The bus in the service bay has feeder circuit breakers, each feeding a small distribution board in Zone 4. The fourth zone contains molded-case circuit breakers which in turn feed miscellaneous loads.

There is one 480-volt unit auxiliary power board for each generating unit. Each receives energy from the unit 4160-volt board under normal conditions and from one of the 480-volt common boards under standby conditions. Each of the unit auxiliary power boards is a unit substation and consists of a power transformer, a main circuit breaker, and a group of feeder circuit breakers.

The main and tie circuit breakers also are arranged in an automatic throwover scheme except that two instead of three circuit breakers are involved. The main circuit breaker is normally closed; upon loss of voltage this breaker trips, and the tie circuit breaker closes. With the return of normal voltage, the tie circuit breaker trips, and the main circuit breaker closes. An overcurrent or fault current oc-

curing when the main circuit breaker is closed causes the main circuit breaker to lockout. An overcurrent or fault current when the tie circuit breaker is closed causes the emergency circuit breaker in the common auxiliary power board to trip and causes the throwover scheme to lockout. The feeder circuit breakers in these boards each feed a small switchboard, which in turn, feeds miscellaneous loads.

System service continuity is achieved by setting up certain conditions and coordinating the equipment around them. Those conditions could have been met in a number of ways, but the equipment and design finally selected is desirable from an economic as well as an engineering point of view. The automatic throwover scheme, by preventing the paralleling of two sources, reduces the interrupting capacity required of the circuit breakers; in turn, this reduces the over-all size of the switchgear.

Direct-acting series overcurrent devices are rugged and simple, and have an accuracy comparable to that of current-transformer-operated relays. Less panel space is required since the device is mounted on the circuit breaker itself, again resulting in a reduction of switchgear size. System requirements and operating standards were set up by T.V.A.; switchgear coordination and application were made by I-T-E Circuit Breaker Company.

Radio Paging System Uses Vest Pocket Receiver

NEW RADIO PAGING systems, in which subscribers carry vest-pocket radio receivers called "Page-ettes," are in operation in several major cities. They are being set up by the New York Technical Institute of Cincinnati, Ohio, which developed the tiny receiver.

A transmitter is installed at the paging service headquarters in each city. Anyone desiring to page a subscriber telephones this headquarters. Within two minutes the message is on the air and repeatedly broadcast for an hour.

A subscriber lifts the six-ounce receiver to his ear once every hour and pushes a button to listen. Upon hearing his name, or an assigned number, he telephones the party paging him, or follows specific instructions included in the broadcast.

Such systems are now operating in Cincinnati, St. Louis, Mo.; Cleveland, Ohio; Philadelphia, Pa.; and Minneapolis, Minn. The number of subscribers in individual areas varies from 100 to 750.

Systems are now in the process of installation in Detroit, Mich. and Pittsburgh, Pa. Authorizations have been received from the Federal Communications Commission for additional systems in Columbus, Ohio; Indianapolis, Ind.; and Buffalo, N.Y.

Effective range of the new radio systems are from

25 to 35 miles, depending upon the location of the transmitting antenna, and type of terrain covered. The vest-pocket receivers operate in most downtown city locations, including the interior of buildings.

The transmitters being supplied by General Electric operate at 250 watts. They are the type used in police and fire department radio networks. They operate on a frequency of 43.58 or 35.58 megacycles, which are frequencies set aside by the FCC for use by one-way paging systems.

To permit fast insertion of new messages, N.Y. Technical Institute developed a magnetic drum recorder, two of which are used at each headquarters station. The entire list of messages is transcribed on one drum, which is played back continuously over the radio station. While this drum is on the air, the operator is able to record a complete list on the second drum, with any additions or deletions. The second drum can then be switched into the playback circuit, and the process repeated.

Charges for the radio paging service vary from \$5.00 to \$20.00 per month, depending upon the type of service desired. A subscriber may contract for a limited number of calls, or may even have extension receivers throughout his organization.

STOWE *Stoker*

DOUBLES OUTPUT OF OLD BOILER

Restoking a 545 H.P. boiler increases output from 18,000 to 40,000 lbs./Hr. using the same coal—with a minimum of downtime—and expense.

- The fastest way to get more steam—and the cheapest—is to restoker one of your present boilers with a Stowe Stoker.

FOR EXAMPLE

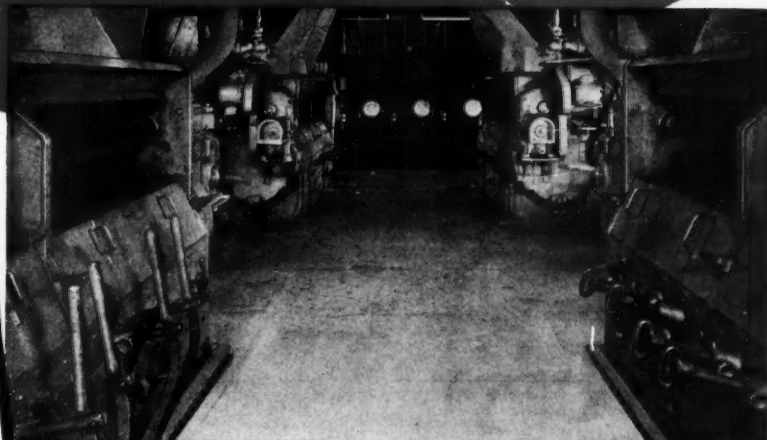
A LARGE TIRE FACTORY restokered one boiler with a Stowe Stoker, doubling its output—then restokered 3 more—is now getting 60,000 lbs. more steam from the same 4 boilers.

A LARGE ENGINE MANUFACTURER restokered one boiler with a Stowe Stoker—doubled its output—and has since installed Stowe Stokers under four more old, and three new boilers.

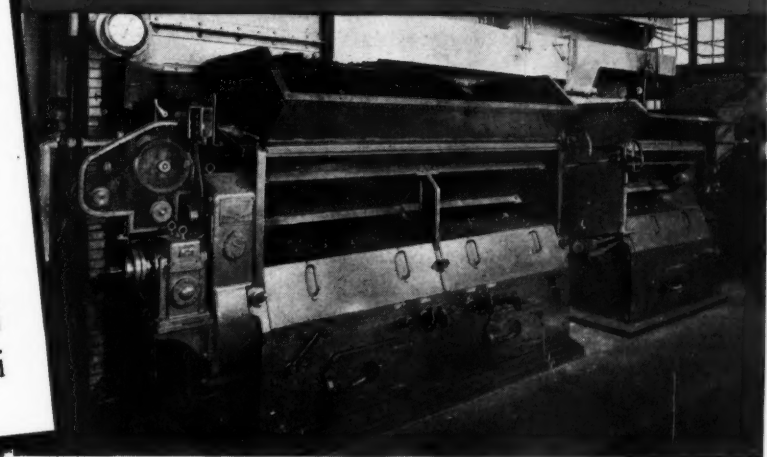
A METROPOLITAN UNIVERSITY restokered a small 300 H.P. boiler, saved \$9,000 in coal costs the first heating season and has since restokered a 500 H.P. boiler and bought one more Stowe for a new boiler.

HERE'S WHY

High burning rates per sq. foot of grate area—even depth of fuel bed and uniform air distribution are some of the reasons Stowe Stokers perform so well. Why not get full details. Write for Bulletin No. 501. It tells what Stowe Stokers do—and why they are able to do it.



Above: View of Four Boilers in Large Rubber Factory Restokered with Stowe Stokers.
Below: Two Boilers in Metropolitan University Restokered with Stowe Stokers.



"More Power to You" with **STOWE**
Stokers

Manufactured by THE JOHNSTON & JENNINGS CO. • 6917 Bessemer Avenue • Cleveland 27, Ohio
... Division of PETTIBONE MULLIKEN CORP. ...



IN ENGINEERING

★ Chester S. Beard, formerly with Ebasco Services, Inc., where he specialized in pipeline and process instrumentation, has joined Foster Engineering Company, as research and development engineer. He is presently in his second year as president of the Instrument Society of America, N. Y. Section.

★ Sam Tour, general manager of Sam Tour & Co., is elected chairman of the Metallizing Committee of the American Welding Society. He also will retain his present post as chairman of the Sub-Committee on Metallizing for Corrosion Protection, which he has filled for the past two years.

★ Kenneth Brunner is named chief design engineer of Francis H. Bulot, Consulting Engineers, Inc. He formerly was an associate highway engineer for the State of California, Division of Highways. He will make his headquarters in the firm's Pasadena office. Another appointment concerns John T. Robinson, who is named director of project development. He has been practicing for 15 years in the fields of industrial waste disposal; water and sewage system design; treatment plant design, construction and operation.

★ Walter A. Bowers is appointed assistant manager, business department, of Burns and Roe, Inc. He specializes in the electric utility field.

★ Walter Kidde Nuclear Laboratories, Inc. announces the appointment of three department heads as well as the addition of five engineers and two scientists. New department heads include Dr. Cecil B. Ellis, research department, Laboratory Div.; J. J. Byrnes, engineering dept, Laboratory Div.; and Karl Puechle, theoretical dept, Development Div. Staff additions to the Laboratory Div. include G. Bartolomei, Sr., project engineer; D. M. Benforado, junior chemical engineer; and C. W. Stanley, scientist. Additions to the Development Div. include B. J. Byrne, junior engineer; S. Millman, junior scientist; H. Yanowitz, junior engineer; and M. Zizza, junior engineer.

★ Dr. Robert F. Mehl, director of the Metals Research Laboratories and professor of Metallurgy at Carnegie Institute of Technology, will be awarded the Francis J. Clamer Medal by The Franklin Institute at its formal Medal Day ceremonies, October 21. On the same date the Institute will award Dr. Adolph

Meyer the George R. Henderson Medal: "In consideration of his basic contributions to scientific research on the gas turbine power plant, and in particular, to his pioneer work in the development of the first successful gas turbine locomotive."

★ Appointment of A. L. Thurman as executive vice president of the newly-formed Mannesmann-Meer Engineering and Construction Co. is announced by Dr. Gerhard Wagner, president. Thurman will be responsible for the development of the new firm, which has been organized for the engineering, sale and manufacture of seamless tube mill machinery. The company will also offer a complete engineering service for the planning, installation and operation of metal working and metal producing industries. Headquarters will be at 900 Line St., Easton, Pa.



THURMAN



COBB

★ New engineering manager of Westcott & Mapes, Inc., New Haven, Conn., is Edgar E. Cobb. In this capacity he will direct all architectural and engineering services for the firm. He formerly was chief of the electrical division.

★ Appointment of A. H. Candee, formerly with Westinghouse Electric Corp., as motive power consultant is announced by Engine Div., The National Supply Co. He will advise on applications of locomotive diesels in additional areas of use.

★ Dr. Aaron Wexler is appointed manager of the magnetics and solid state physics department of the Westinghouse Research Laboratories.

★ Chester A. Siver is elected vice president and general manager of engineering, Black, Sivalls & Bryson, Inc.

★ Fred A. Robbins is named chief engineer of the Piston Ring Dept., of Koppers Company, Inc. In his newly-created position he will be in charge of all engineering activities for American Hammered Industrial Piston Rings and will work directly with clients on engineering problems.

★ Whitney Collins, since 1951 project manager on gas turbine engines

(Continued on page 68)



LONG SERVICE

Representing a total of 135 years of service at Caterpillar Tractor Co. or its predecessor, Holt Mfg. Co., are: left to right, L. B. Neumiller, president; H. S. Eberhard, executive vice president; J. R. Munro, director of manufacturing; and Ralph Morgan, executive assistant. The occasion was presentation of diamond service pins to Munro and Morgan.

NO Reducing Valve Needed

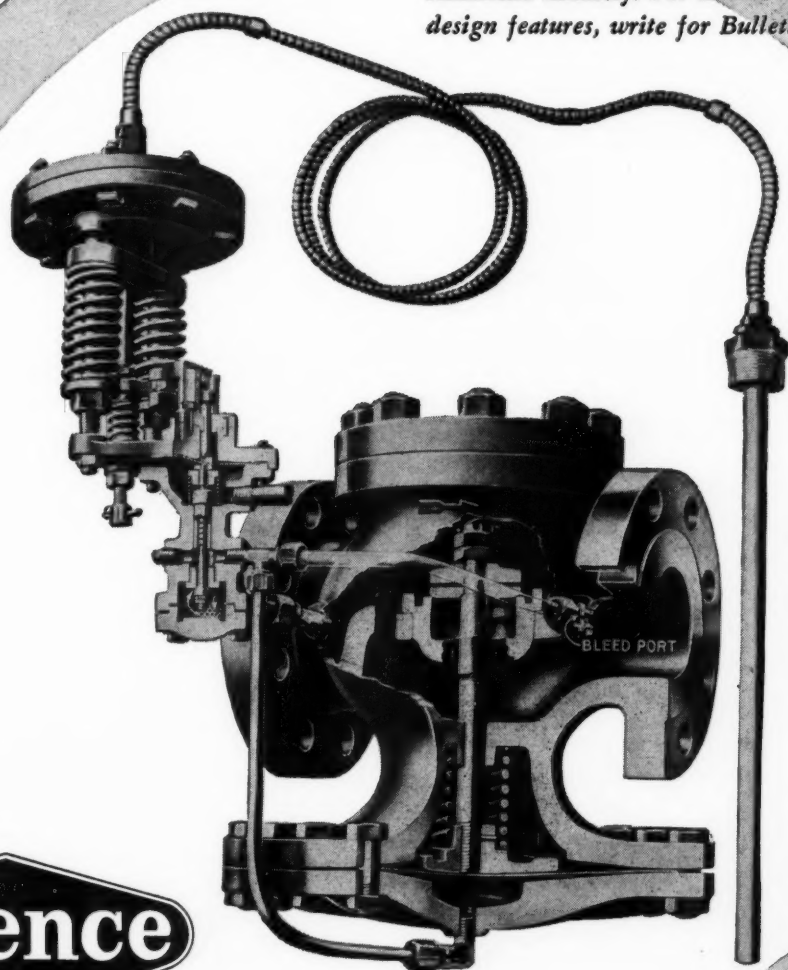
Here's real economy in temperature control.

Because Spence Temperature Regulators are designed to limit heater steam pressures to an adjustable maximum, the need for a separate reducing valve is completely eliminated.

The Spence Regulator takes steam directly from the boiler or high pressure line, reduces the pressure and regulates the flow as required to maintain a constant temperature output from the heater.

This means one relatively small combination pressure and temperature regulator replaces a reducing valve of the same size and a larger temperature regulator. Practically the entire cost of the large separate temperature regulator is saved. And, the total saving would also include the cost of a 3-valve by-pass along with all labor for installation.

This design feature is just one of the reasons for the thousands of Spence installations throughout American industry. *For details of other important design features, write for Bulletin T50.*



**SPENCE
TYPE ET150
Temperature
Regulator**

Spence

**SPENCE ENGINEERING
COMPANY, INC.
WALDEN, NEW YORK**

SEPTEMBER 1953

67

Understanding Corrosion:

THE EFFECT OF HUMIDITY

Relative humidity — the degree to which air is saturated with moisture — influences corrosion in one direction where metal is exposed to atmosphere and in another where it is immersed in a solution surface-exposed to the same atmosphere.

It is humidity, in combination with temperature, that determines whether moisture can exist on a metal surface. Because moisture is essential to atmospheric corrosion, humidity, at normal temperatures, becomes the factor that determines whether corrosion will occur and to what extent. Its effect, negligible below 30%, increases until a critical point is reached at about 65%. When air so moisture-laden carries even minute quantities of such gases as sulphur dioxide, corrosive action is greatly intensified. It is this condition that renders difficult the protection of steel stacks, breechings and economizers in service below the dew point.

For metal immersed in a corrosive solution, the reverse is true. More rather than less humidity in

the air above is the preferable situation because of the way in which humidity influences the rate of oxygen solution. The rapid evaporation that occurs in dry atmosphere leaves a cool, dense surface layer of liquid that carries dissolved oxygen through the solution as fresh, unsaturated liquid replaces it for a repetition of the process. As the pace at which oxygen is brought in contact with the metal is thus stepped up, corrosion increases proportionately.

Protection of metal exposed to atmosphere or immersed in corrosive solutions, particularly under difficult or unusual service conditions, has long been the function of Dampney equipment-engineered coatings. Our experience in the handling of corrosion problems peculiar to industrial power and processing operations is not only extensive but specific . . . applicable, we feel sure, to your individual needs. Let us tell you more about Dampney coatings and what they offer . . . in terms of *your* requirements.

MAINTENANCE
FOR METAL



THE
DAMPNEY
COMPANY

HYDE PARK, BOSTON 36, MASSACHUSETTS

155-1

MEN

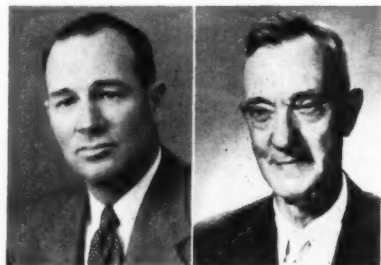
—Starts on page 66

at Continental Aviation & Engineering Corp., is appointed chief engineer of the company's recently-formed Gas Turbine Div.

★ Charles H. Smith, who joined the L. J. Wing Mfg. Co. in 1920, is named vice president, and now heads the Combustion Div., in addition to his duties as secretary and director.

★ Dr. Lawrence W. Bass recently left for Egypt where he will be administrator of the Arthur D. Little, Inc. industrialization project for that country.

★ Appointment of James G. Kintner as vice president in charge of engineering of American District Steam Company, Inc. is announced. Kintner, chief engineer of ADSCO since 1950, will head up an increased engineering program.



KINTNER

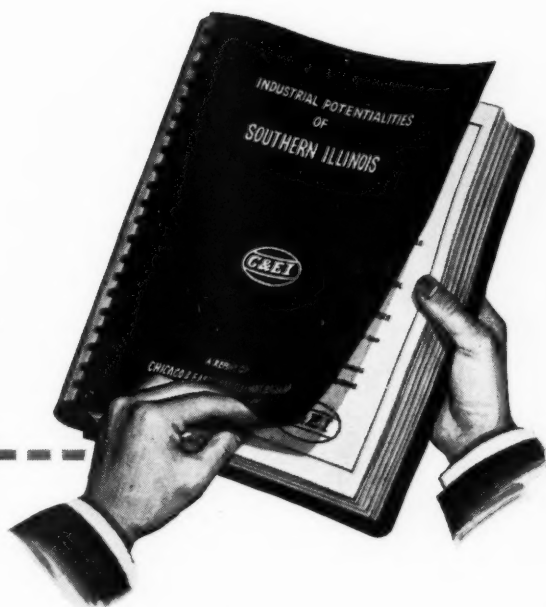
SNOWBALL

★ John R. Snowball, formerly associated with the Portland Cement Association, is appointed consulting engineer to The Marietta Concrete Corp. His duties will consist of calling on architects and engineers to provide them with information and assistance in the uses of concrete products.

★ J. A. Cameron is appointed executive vice president and assistant general manager of The Marley Co.

★ William R. Benn, safety engineer of The H. K. Ferguson Co. is elected chairman of the safety committee of the National Constructors Association.

★ Soil Testing Services, Inc. announces the opening of its new offices and testing laboratory at 3529 N. Cicero Ave., Chicago 41. Activities of the firm are directed by J. P. Gnaedinger, president and C. A. Metz, vice president. Services offered include complete laboratory test facilities for engineering tests on soils, field inspection for placement of foundations and control of compacted fills, engineering reports and recommendations for the design of foundations.



Available for the Asking

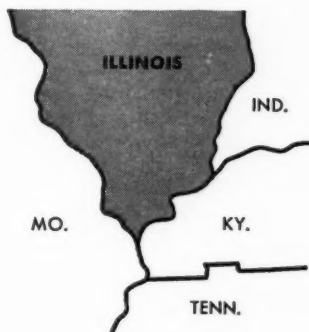
Complete Site Survey Data on Southern Illinois

Never have Consulting Engineers had such complete support for establishing the industrial potentialities of Southern Illinois. This new, completely documented report can save you days of research . . . can serve as a starting point for site studies you make of the area. Every economic and geographic factor

necessary for determining the industrial opportunities of Southern Illinois and adjacent areas has been included in order that you may analyze the data in relation to your client's needs. This complete survey data is yours for the asking. Take advantage of this unusual opportunity now.

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- Maps showing location of minerals, timber, crops, railroads, power supplies, communications, labor sources, marketing areas and many other necessary site factors.



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From Anywhere
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BOOKLETS

GATES AND VALVES for handling bulk materials are briefly described in 20-page catalog 1252. Advantages, applications, construction, and dimensions are presented for each type. In addition to conventional units such as slide gates and quadrant gates, the booklet presents newly developed units including a double closure bin valve and a new bin gate. *Stephens-Adamson Mfg. Co., Aurora, Ill.*

PIPE & PIPE FABRICATION—Specifications for all sizes of pipe from 1/8 to 24 in. diameter are presented in 16-page catalog 575C. Tables list data and descriptions of standard, extra strong, and double extra heavy pipe, spiralweld pipe, large OD pipe, line pipe, electric-weld tubing, welding fittings and flanges, oil well casings, and water well casing. Facilities for fabricating pipe for structural uses also are described. *L. B. Foster Co., P. O. Box 1647, Pittsburgh 30, Pa.*

FLUID DRIVES—Operating principles for variable speed fluid drives are discussed in 24-page bulletin 0319. Component parts, applications, advantages, dimensions, auxiliaries, and controls are discussed. Included in an engineering section are constant torque charts and tables on speed reduction factors. *Hydraulic Coupling Div., American Blower Corp., Detroit 32, Mich.*

SELF-POLICING ANNUNCIATOR systems for industry are described in 6-page bulletin M-I-GP-SM. Operation and advantages of the three components of such a system are discussed. A typical wiring diagram and dimensions drawing are included in addition to a table of standard signal sequences. *SCAM Instrument Co., 3909 W. Irving Pl., Chicago 18.*

RECIRCULATION CONTROL SYSTEMS for protecting high capacity centrifugal boiler pumps during low load conditions is the subject of 12-page bulletin S-53. Information for determining when such control is needed is included as well as operation and arrangement of electrically and pneumatically operated control systems. Valves and control equipment for each system are also pictured and specifications given. *Republic Flow Meters Co., 2240 Diversey Pkwy., Chicago 47, Ill.*



HIGH PRESSURE FORCE FEED lubricators, designed for service at pressures to 30,000 psi, are described in 12-page catalog 25C. Tables show output, dimensions, and specifications. Detailed information is given on how to order the correct unit and fittings for your job. *Manzel Div., Frontier Industries Inc., Buffalo, N. Y.*

ZEOLITE WATER SOFTENERS are the subject of 12-page bulletin WC-108. It explains the distinction between the sodium and hydrogen cycle, and shows the differences in results. Design and operation of zeolite equipment is described, and available methods for controlling various operations are discussed. An appraisal

(Continued on page 72)

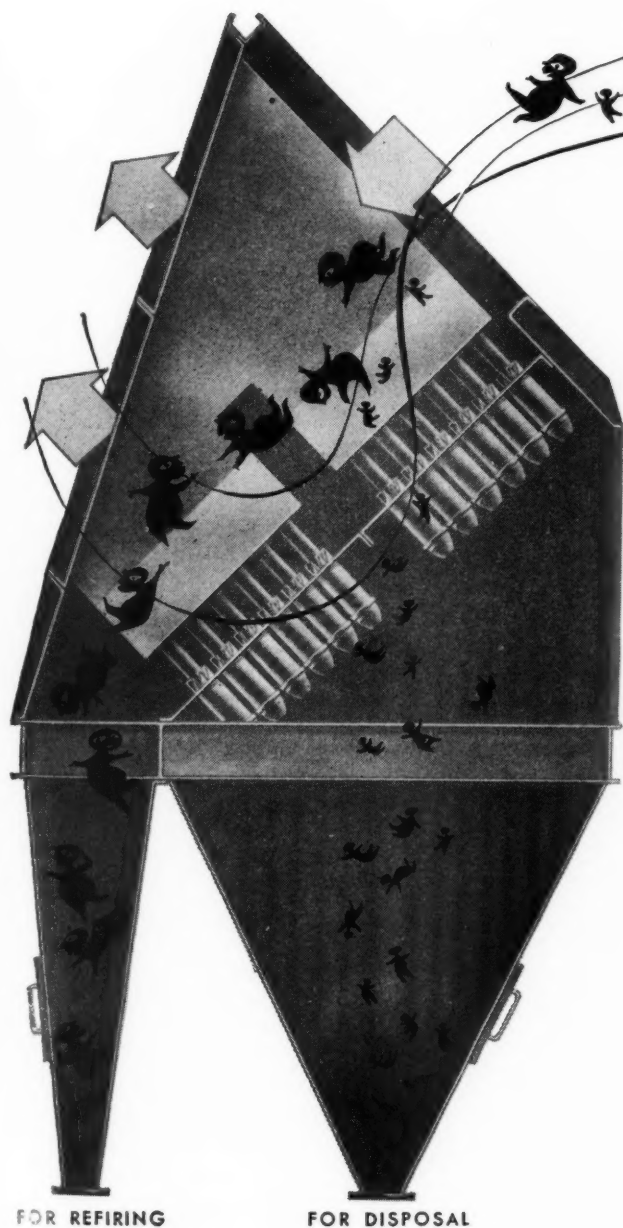
Personal copies of booklets can be obtained by writing directly to the manufacturers.

CONSULTING ENGINEER

the



Decantation Principle



**Catches the small ones
(flyash) and lets the
big ones go . . .**

back to the boiler for refiring

Separation of the fines from coarse high carbon flyash for refiring is at last possible in one unit, with no added pressure drop.

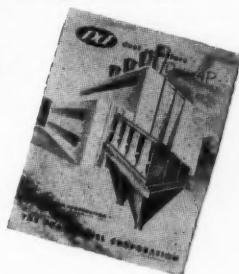
Prat-Daniel's Tubular Dust Collector, arranged for Decantation, permits efficient refiring of high carbon dust *without* recirculating the fines!

The P-D two-stage tubular collector is combined in *one* unit yet is no larger in area than a standard P-D Collector. In operation, it requires no additional pressure drop yet assures an extremely high efficiency in the range below 20 microns!

The Thermix Corporation—Project Engineers for Prat-Daniel—will be glad to show you how Decantation saves fuel and eliminates poor combustion resulting from total re-injection.

Ask them for full details on P-D Dust Collectors, Fan Stacks, F.D. and I.D. Fans, P-D Unit Responsibility on these components relieves you of the necessity of integrating equipment from various sources . . . helps make your operation more efficient, less costly. It will pay you to call Thermix today.

Ask for P-D Catalog 4-P201.



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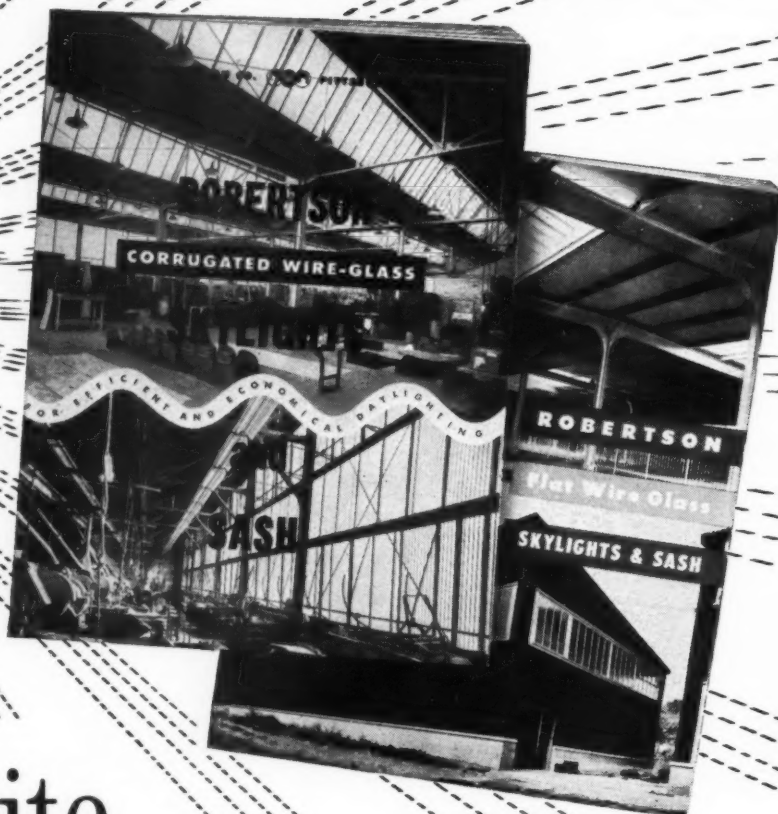
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2431

BOOKLETS —Starts on page 70

of ion exchange materials includes a table of characteristics. A simplified method of sizing zeolite softeners and a table of recommended flow rates aid in equipment selection. *Graver Water Conditioning Co., 216 West 14th St., New York 11, N.Y.*

HEAT EXCHANGERS and hot water storage heaters are the subject of 16-page catalog 5. Included among the various types of equipment are horizontal and vertical hot water storage heaters, instantaneous water heaters, converters, condensate coolers, fuel oil heaters, and instantaneous suction heaters for viscous fluids. In addition to discussing applications and construction, the literature presents tables to aid in selecting proper equipment. Typical examples demonstrate use of the tables. *Patterson-Kelley Co., Inc., East Stroudsburg, Pa.*

RECORDING POTENTIOMETER—Cutaway drawings of operating sections stressing simplicity of construction are given in 14-page booklet P-2-A. The method of changing chart speed and range is explained. Standard chart ranges, specifications, and information on how to order are listed for the single point recorder. *Weston Instrument Corp., 614 Frelinghuysen, Newark 5, N. J.*

COATING AND ADHESIVE products for use in the installation and surface protection of industrial insulations are described in detail in a 20-page manual. Technical data, recommended uses, specifications, and limitations are given for 36 such products. Engineers, contractors, and others working with thermal or acoustical insulations, and facing the problem of protecting insulated pipelines and equipment from chemical or physical damage will find this a useful reference booklet. *Benjamin Foster Co., 4639 W. Girard Ave., Phila. 31, Pa.*

OIL AND GAS BURNER—Described in 16-page bulletin ID53-162 is a factory-coordinated, industrial fuel burning system. Built around an industrial burner for oil or gas firing, the system includes: controls mounted in panels and wired to terminal strips for easy connection; factory engineered windbox and refractory ring; fuel oil heaters; and trim. How the system works is fully described, and ease of installation is stressed. Construction features and specifications are given. *Industrial Div., York-Shipley, Inc., York, Pa.*

(Continued on page 74)

It's all there

everything needed for easy, quick installation

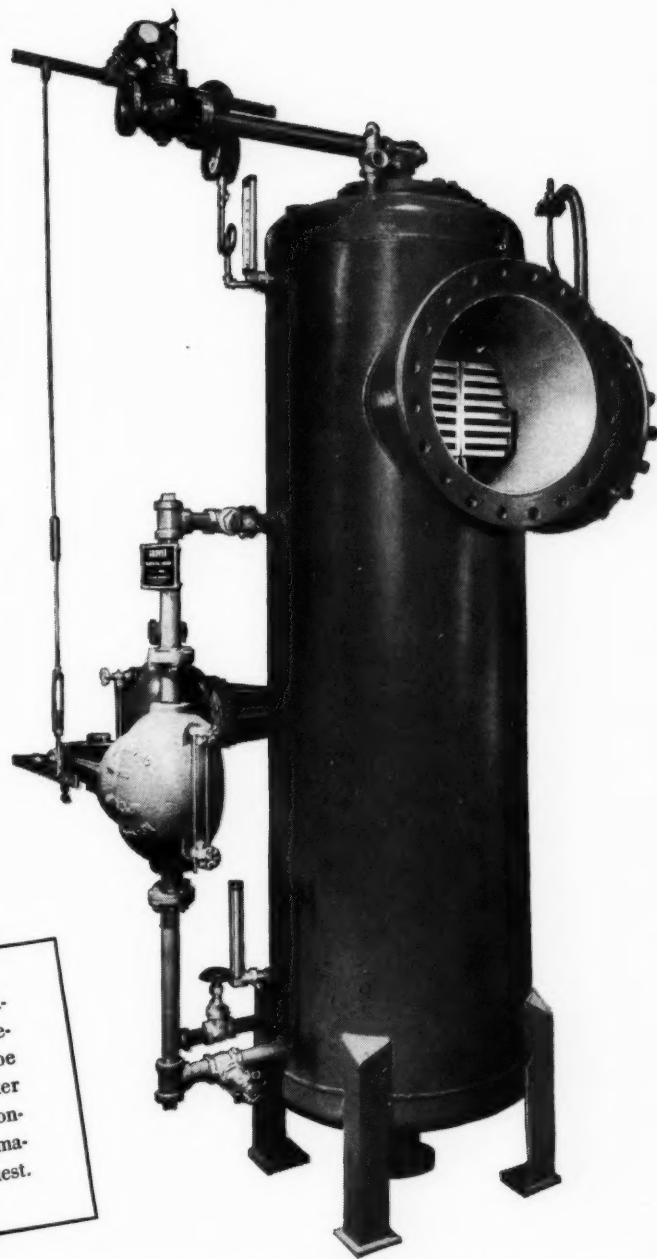
When you buy a Graver Packaged Deaerating Heater, it comes to you *complete*.

This means that the unit includes *all* internal parts, controls, valves and instruments you need for the installation. There will be nothing to wait for . . . nothing more to buy.

And *shipment* will be quick, too, because these units are *standardized* . . . pre-engineered for your speedy selection from a wide range of capacities in either the spray or spray-tray types.

While these Graver Packaged Heaters are built in sizes for the *smaller* plant, every part and every accessory is of the highest quality design, construction and workmanship . . . subjected to the same rigid specifications as the Graver Heaters of 1,000,000 lb. per hr. or more, built for the largest power generating stations.

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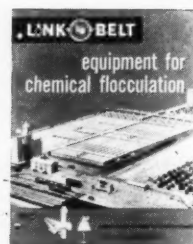
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City.....Zone.....State.....

— OFFICES IN PRINCIPAL CITIES —

BOOKLETS —Starts on page 70

MEASURING DEVICES — Information on more than 115 testing and measuring devices are contained in 64-page catalog GEC-1016A. A brief description of each product and its field of application, condensed tables of important characteristics, and prices indicate whether or not the instrument is suited for a specific job. Products range from simple current indicators to completely automatic oscillographs, and from surface roughness scales to mass spectrometers. *General Electric Co., Schenectady 5, N. Y.*



CHEMICAL FLOCCULATION conveying and mixing equipment for use in water, sewage, and industrial waste treatment plants is described in 8-page booklet 2442. Installation photographs show many types of conveying and elevating equipment for economical handling of bulk or packaged chemicals. Flash and straight line mechanical mixers are described in detail and inserts contain general arrangement drawings and specifications. Tested layouts and selection tables to aid in determining tank size for required circulation flow are included. *Link-Belt Co., 307 N. Michigan, Chicago 7, Ill.*

REINFORCING MESH for use with masonry wall construction is described in a 4-page folder. Recent improvements, discussed in the literature, are described as providing better bonding, greater strength, and improved results. Data obtained by an independent research laboratory on pull, side pressure, and shrinkage crack tests are given. Recommended uses and specifications are listed. *Adrian Peerless, Inc., 1401 E. Michigan St., Adrian, Mich.*

"ALCOA ALUMINUM IN THE PROCESS INDUSTRIES," 8-page booklet AD 278 tells of the uses of aluminum in such industries as plastics, soaps, cosmetics, drug products, sulphur, petroleum, and chemicals. Economic advantages of aluminum, and tables covering materials handled safely with aluminum, composition and

(Continued on page 76)

CONSULTING ENGINEER

STAINLESS STEEL VALVE COMPARISON CHART

BASED ON 2" GATE	COOPER ALLOY	COMPETITORS		
		A	B	C
Ball and socket rotating type disc for positive seating with minimum galling	✓	✓		
Discs and seats designed for simple reconditioning in the field	✓	✓		
Centerless ground stock to cut packing wear	✓	✓		
3/4" minimum stem diameter to assure rigidity	✓		✓	✓
Deep stuffing box with six turns of 1/4" square packing	✓		✓	
Packing gland designed to deliver square, uniform compression	✓			
Two piece gland construction to prevent gouging of the stem	✓	✓		✓
Swinging eyebolts to simplify repacking and provide added safety	✓			
Simplified yoke nut construction to permit replacement without interrupting service	✓			✓
Grease fitting to eliminate friction on yoke nut during opening and closing	✓			
100% x-ray of vital cast components	✓			
A stainless steel valve designed and produced by stainless steel specialists	✓	✓		
Stocked in major industrial areas by nationwide distributor organization	✓		✓	✓
Rugged construction for tough corrosive service—compare these weights!	33-lbs.	28-lbs.	28-lbs.	24-lbs.
7" minimum diameter wheel for simplified hand closing	✓			

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VALVES
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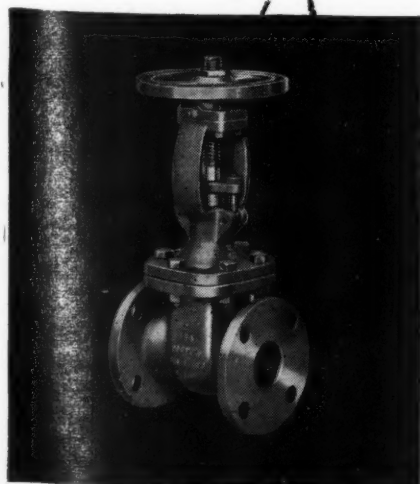
Our thirty years of experience in the casting of high alloys is your guarantee of the best in stainless steel valves, fittings and accessories. To get the full details, write today for your free copy of our 2" valve comparison chart.



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BOOKLETS —Starts on page 70

properties of aluminum alloys, and other engineering information are included. Photographs illustrate uses of these products in industry. Folder AD 277 discusses aluminas and fluorides. Aluminum Co. of America, 808 Alcoa Bldg., Pittsburgh 19, Pa.

ORIFICE METERS are the subject of 28-page booklet 1050 Rev 1. Construction features and operation are appraised. Capacity tables offer time-saving help in sizing orifice meter plates. How meters are used with liquid seal chambers and piping for steam, corrosive gases, and liquids, is discussed. Also included are instructions for meter testing and operating practice, square root charts, and instructions for testing differentials. Rockwell Manufacturing Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.

HYDRO-FOAM DUST COLLECTORS and fog filters in typical installations are presented by 12-page bulletin A-654. Special applications for each unit are pictured in addition to cross sectional drawings which describe operation. Finishing systems such as spray, dip, and flow coating are discussed along with special production equipment. R. C. Mahon Co., Detroit 34, Mich.

"INSTRUMENTS FOR MODERN MEASUREMENTS," 34-page brochure, illustrates and describes over 37 different instruments. Each unit is indexed according to the type of job done, such as physical, resistance-welding, textile, and electro-acoustical measurements, and ultrasonic energy applications. This should be of special interest to research engineers and methods and production engineers. Brush Electronics Co., 3405 Perkins, Cleveland 14, Ohio.

ELECTRONIC TOUCH BUTTONS and door detectors for passenger operated elevators are described in two, 4-page folders, 2054-2540 and B-807. Circuit diagrams and sectional drawings explain the operation of both devices. Advantages of electronic controls over standard types are listed. Otis Elevator Co., 260 11th Ave., N. Y. 1, N. Y.

REFRIGERATION EQUIPMENT, its installation, maintenance, and servicing, when used in conjunction with air conditioning systems, is the subject of revised 125-page manual

(Continued on page 78)

CONSULTING ENGINEER

Here's why Libby, McNeill
& Libby chose.....

DRAVO *Counterflo*
SPACE HEATERS
again for their 10 acre
Hammond Warehouse



Food cartons at Libby, McNeill & Libby are stacked almost to ceiling level. Dravo Heaters were modified with sheet-metal extensions to raise discharge nozzles above stack level.



When Libby, McNeill & Libby acquired an existing warehouse at Hammond, Indiana, for use as a huge food-order assembly warehouse, a complete new heating system had to be installed. These were the problems Libby faced:

1. Providing low-cost comfort heat and air conditioning throughout a 426,000 sq. ft. building area.
2. Preventing food from freezing in sub-zero weather.
3. Eliminating year-around dampness and humidity which caused rust on cans, loss of labels and carton damage.

Based on previous experience with Dravo *Counterflo* Space Heaters in its other warehouses, Libby installed 30 Dravo Heaters in this building to overcome these problems. This is why Libby chose Dravo:



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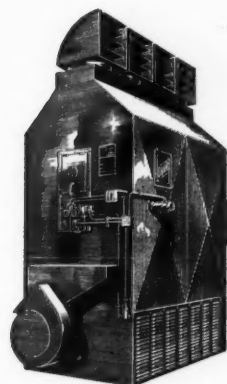


ECONOMY—Dravo Heaters' maximum air throw eliminated the need for ductwork except for several short runs, thus kept installation costs low. The Dravo recirculation system keeps roof-heat losses at a minimum; maintenance costs have been negligible.



EFFICIENCY—Dravo Heaters' automatic thermostat control maintains a uniform warm temperature throughout the warehouse in winter; no regular attendant is needed. Forced air ventilation removes humidity and eliminates food spoilage and packaging damage.

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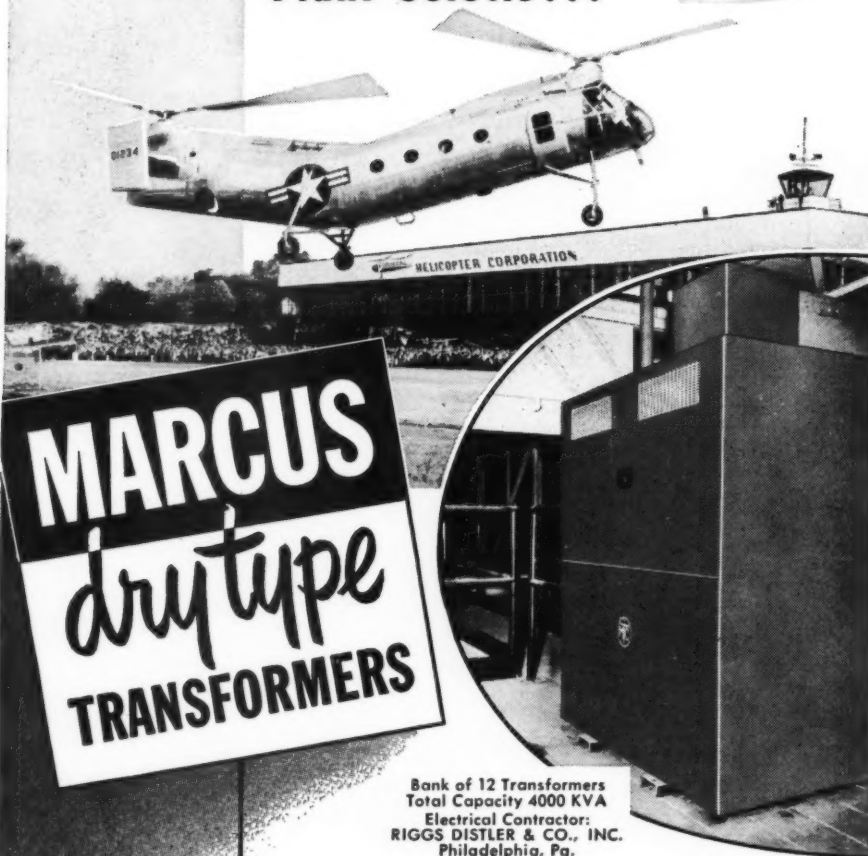


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BOOKLETS —Starts on page 70

M361-5. It begins with a discussion of refrigerants and the refrigeration cycle and goes on to give detailed information concerning all the component parts of such systems. Included are new chapters on piping and controls and a revised chapter on service operation. The service analysis chart has been revised. Price \$1.50. *The Trane Co., LaCrosse, Wis.*

DEMAND METERS—Theory and economics of demand metering, as well as the operation and application of meters, is discussed in 48-page manual GET-2327. The booklet, which provides an excellent summary of the principles and problems of demand metering, should serve as a helpful reference for specific applications. Rather than emphasize details of meter construction, installation, or maintenance, the manual serves as a centralized source of basic information. *General Electric Co., Schenectady 5, N. Y.*



HEAT EXCHANGER CALCULATOR—Providing all necessary data for the selection of shell and tube type heat exchangers, manufactured by this company, is a handy 2-color calculator designed like a slide rule. The calculator is used to determine the square feet of surface necessary to transfer a given amount of heat between oil or water on the shell side, and water on the tube side. Simple operating instructions and tables of tube surface areas are included. *Young Radiator Co., Racine, Wis.*

FERTILIZER PLANTS and equipment featuring recent improvements in processing techniques are the subject of 16-page booklet 2459. Perspective flow diagrams and installation photographs show typical arrangements for processing materials such as ammonium nitrate, superphosphate, triple superphosphate, and granulated mixed fertilizer. Types of equipment are discussed along with improved methods. *Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill.*

consulting engineers' calendar

Date	Sponsor	Event	Location
Sept. 21-25	Industrial Inst. & Regulator Division American Society of Mechanical Engineers	Exhibit and Conference	Sherman Hotel Chicago, Illinois
Sept. 28-30	National Electronics Conference	9th General Conference	Sherman Hotel Chicago, Illinois
Sept. 28-30	American Society of Mechanical Engineers	Petroleum-Mech. Eng'r Conf.	Rice Hotel Houston, Texas
Oct. 5-7	American Society of Mechanical Engineers	Fall Meeting	Sheraton Hotel Rochester, N. Y.
Oct. 6-8	Elec. League of Western Penn.	4th Industrial Elec. Expo.	William Penn Hotel Pittsburgh, Pa.
Oct. 6-8	American Institute of Electrical Engineers	Fractional HP Motor Conf.	Hotel Keenan Ft. Wayne, Ind.
Oct. 8-9	Illinois Institute of Technology	Conf. on Ind'l Hydraulics	Sherman Hotel Chicago, Ill.
Oct. 17-20	Conveyor Equipment Mfrs. Assoc.	Annual Meeting	Greenbrier, White Sulfur Springs, W. Va.
Oct. 19-23	American Society of Civil Engineers	Annual Meeting	Statler Hotel New York, N. Y.
Oct. 19-23	National Safety Council	National Safety Congress	Conrad Hilton Hotel Chicago, Ill.
Oct. 23-24	Armour Research Foundation	Nation Noise Abatement Symposium	Ill. Inst. of Tech. Chicago, Ill.
Oct. 27	Consulting Chemist and Chem. Eng'rs.	25th Anniversary Meeting	Belmont Plaza Hotel New York, N. Y.
Oct. 28-30	American Management Association	Manufacturing Conference	Belevue-Stratford Philadelphia, Pa.
Nov. 2-6	American Institute of Electrical Engineers	Fall General Meeting	Hotel Muehlebach Kansas City, Mo.
Nov. 4-6	Industrial Management Society	Time and Motion Study and Management Clinic	Sheraton Hotel Chicago, Ill.
Nov. 9-12	Refrig. Equip. Mfrs. Assoc.	Refrig. & Air Cond. Exp.	Public Auditorium Cleveland, Ohio
Nov. 29- Dec. 4	American Society of Mechanical Engineers	Annual Meeting	Statler Hotel New York, N. Y.
Nov. 30- Dec. 5	Exposition of Chemical Industries	Exhibit	Commercial Museum Philadelphia, Pa.
Dec. 13-16	American Institute of Chemical Engineers	Annual Meeting	Jefferson Hotel St. Louis, Mo.

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GAS TURBINES

ANALYSIS AND PRACTICE



By B. H. Jennings, Prof. and Chrmn., Dept. of Mech. Eng., and W. L. Rogers, Ass't. Prof. of Mech. Eng. Both of the Technological Inst., Northwestern Univ.

487 pp., 200 illus. \$8.50

This thoroughgoing analysis of the modern gas turbine gives you design information... operating characteristics... and industrial scope and uses of this new source of power. It explains the basic principles of various types of gas turbines and provides a careful coverage of the thermodynamics necessary to an understanding of the subject. You get detailed material on fuels, types of compressors, stresses and strains, the metals used, and the metallurgy involved in the design of efficient, economical power units.

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- 6—Centrifugal and Displacement Compressors
- 7—Aircraft and Jet Propulsion
- 8—Power Plant and Transportation Turbine Units
- 9—Fuels, Combustion and Combustion Chambers
- 10—Stresses in Turbine Plant Elements
- 11—Vibration and Balancing
- 12—Materials and Metallurgy

The book provides the ideal balanced treatment of fundamentals, applications, and examples of modern equipment. Practicing engineers will appreciate its many features, especially its stress on fundamental concepts of thermodynamics, and the extensive coverage of compressor types. Included in this latter section is material on the Lysholm compressor, and the relatively new "free piston" designs.

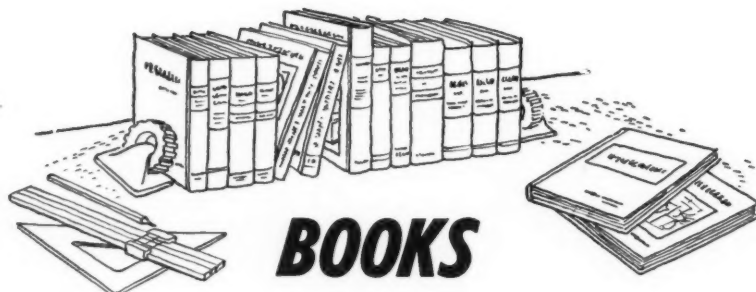
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MEASUREMENT TECHNIQUES IN MECHANICAL ENGINEERING, by R. J. Sweeney; John Wiley and Sons, Inc. 309 pages, \$5.50.

Reviewed by Fred T. Morse
Professor of Mechanical Engineering
University of Virginia

This book concentrates on the explanation of principles on which instruments function rather than design details.

A discussion of the general theory of measurements opens the book. The author then covers the standard measurement of distance, mass, and time, and some of their derivatives such as area and speed.

Electrical measurements, particularly as they might be wanted to determine the input to motors which drive machines, are next described. To these is added an explanation of the bridge circuits which are sometimes used to calibrate pointer-type electric instruments.

Power measuring dynamometers of the mechanical, hydraulic, and electric types are described, but details of their usage in the test field are not included.

The field of pressure and temperature measurement is covered descriptively in a comprehensive manner. Engine indicators are considered to be pressure recording instruments, hence accorded a place with pressure measurements. More thorough treatment of the pressure pick-up-oscillograph combination so widely used in high speed I. C. engine work could well have been included. Also, it would seem that the multiple station, high speed recording potentiometers should have been described.

A section on Fluid Flow embraces velocity and displacement types of flow meters for liquids and gases;

also those less familiar forms which employ the cooling effect of a fluid stream to create a measurable thermal or thermo-electric effect.

Two forms of calorimetry are described—that used to determine the dryness factor of steam, and that employed to measure the heating value of fuels. While the former is adequate, the latter needs considerable reinforcement from other sources for a suitable working background for the handling of these apparatus.

Discussion of measurements concludes with a chapter on Chemical Analysis in which gas analysis (products of combustion) is explained and some of the simple water tests are mentioned. The proximate analysis of coal is also taken up here, although it is a physical rather than a chemical analysis. Actually the proximate analysis is a test procedure and the only measurement technique involved is the exact weighing of small samples by means of the analytical balance.

The book ends with a discussion of automatic control valves. Since Control Engineering is a vast and complex subject, the treatment is of necessity quite elementary.

This small volume surveys an extensive assortment of mechanical and electrical measurements. It should be very useful as a reference for the mechanical engineer confronted with an extensive program of laboratory study of mechanical and thermal apparatus. The practicing engineer embarking on field tests and finding himself "rusty" on measurement procedures would be able to form a background for his problems with this book. In many instances the author indicates where to go for more specialized

or detailed information on a measurement problem.

ALSO AVAILABLE

GOVERNMENT-OWNED INVENTIONS AVAILABLE FOR LICENSE, 1953, U. S. Department of Commerce, \$1.00. This is an index to the complete file of abstract cards describing 3658 government-owned inventions which are available to the public on a non-exclusive, royalty-free basis. Among those products listed are several patents on insecticides and insect repellents, antennas, dry batteries, an X-ray shield, a magnetic-fluid torque and force-transmitting device, an electric-magnetic pump, a counterbalanced crankshaft for internal combustion engines, and many others. Most of these require a minimum of technical development.

WELD STANDARDS, The Lincoln Electric Company, \$1.00. These weld standards are based on procedures developed by The Lincoln Electric Company and the weld symbols of the American Welding Society. The Weld Standards, with a simple letter designation, specify according to plate thickness both the type and size of weld and tell how it should be made. By using these standards, the engineer can be assured that the weld he has specified will produce the results for which it is designed. The standards are available on tracing paper so that they can be blueprinted or otherwise reproduced for the purpose of giving engineers and production personnel a standard for communicating welding procedure on drawings.

NATIONAL ELECTRICAL CODE, 1953 Edition, National Fire Protection Association, cloth bound \$3.00; paper bound \$1.00. The most widely used safety standard of its kind, the National Electrical Code forms the basis for safe electrical appliances and electrical installations in buildings. The 1953 code has been adopted by the American Standards Association. A number of revisions have been included in the new edition.

STATICALLY INDETERMINATE STRUCTURES, by C. K. Wang, McGraw-Hill Book Company, 424 pages, \$7.50. This volume tells how to analyze the deflection of statically determinate beams and frames and how to analyze statically indeterminate structures by a number of different methods. Included is a full discussion of the analysis of fixed arches, of secondary stresses in trusses with rigid joints, and of composite structures.

RAILROAD ENGINEERING, Volume I, by William H. Hay, John Wiley & Sons, 483 pages, \$7.50. The fundamentals of location, operation, maintenance, and construction are here combined to produce a survey of the

current picture and a guide to future development. Wherever the book presents criteria of design and procedure, the recommendations of the American Railway Engineering Association and other technical committees are given. A good book for information on such topics as acceleration and deceleration curves, the velocity profile, application of principles of soil engineering to roadbed construction, and the design of ballast sections, ties, and rails.

OBJECTIVE ACCOUNTING, by Carl F. Braun, C. F. Braun & Co., 80 pages, \$1.75. This little volume was written because of the great gulf which the author feels to exist between accountants and the rest of an engineering organization. He says that it is the purpose of this book to enlist the help of engineers in bridging the gulf. The material in this book was first given as an address to the joint conference of the American Institute of Chemical Engineers and the Chemical Engineering Division of the Chemical Institute of Canada in April of this year.

FIRE TESTS OF STEEL COLUMNS ENCASED WITH GYPSUM LATH AND PLASTER, by Nolan D. Mitchell and James V. Ryan, National Bureau of Standards, 14 pages, 15c. Describes tests on 16 steel building columns protected by gypsum lath and gypsum plaster made from three different aggregates. The columns were subjected to fire periods ranging from one hour and 23 minutes to four hours and 42 minutes.

INDUSTRIAL FILMS

"MINIATURE BEARINGS," 16 mm, sound and color, 15 minutes, Miniature Precision Bearings, Inc., Keene, N. H. The film describes the manufacture and inspection of miniature bearings and their application to precision mechanisms. It shows in detail how bearing rings are machined and polished and how the complete assembly is tested for concentricity, torque, ring diameter and other dimensions and characteristics. It also illustrates the manufacturer's quality control program and packaging methods.

"BRASS MEANS BUSINESS," sound and color, 16-mm, 27 minutes, Titan Metal Manufacturing Company, Bellefonte, Pa., pictures the complex machinery and high level of skills required to produce precision-perfect brass and bronze. Filmed on the brass mill production lines, the picture shows extrusion presses geared for half a million pounds of hydraulic pressure forcing metal through dies into rods. Also shows how research helps develop the right alloy to fit the specific need.

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Licensed Professional Engineer, and

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Contributing Editor, *POWER*

2nd Ed. 373 pp., 417 illus., \$6.50

Here is a complete, practical treatment of all types and designs of pumps and pumping problems for the designer, manufacturer, sales representative, user, and maintenance man. The book discusses a wide range of pump applications, including boiler-feed, condensate, deep-well, sewage and sludge, chemical, oil-field, oil-refinery, paper and pulp mill, and other specialized uses. You will find out what may be expected by way of performance of the various types, as well as their service limitations; how to make clear your requirements to a manufacturer when ordering a specific pump, how to install, operate and maintain pumps, and how to locate and remedy pump troubles.

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